THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XVII MARCH, 1927 No. 3

THE RÔLE OF ROENTGENOLOGY IN MEDICAL EDUCATION

II. OBSERVATIONS ON THE ALIMENTARY TRACT OF THE MEDICAL STUDENT*[1]

BY T. WINGATE TODD, M.B., CH.B.(MANC.), F.R.C.S.(ENG.)

Henry Willson Payne Professor of Anatomy: Director of the Hamann Museum

Western Reserve University

CLEVELAND, OHIO

INTRODUCTION

NO excuse is necessary for a quantitative study of the normal. The wonder is that greater effort has not been made in the past to obtain a comprehensive estimate of normal conditions in the body. This is not due to an erroneous assumption of uniformity in normal anatomy so much as to a recognition of the fact that Nature's guiding principle is uniformity of function rather than of structure. Thus the study of structure has become subservient to the study of function. A secondary contributing cause to this lack of precise information is the relative ease of accumulating observations on pathological material. Quantitative study of the normal for its own sake is expensive and time consuming, whereas the acquisition of facts relating to normality can be more cheaply carried on as a by-product of the investigation of the pathological.

When the subject of research is an organ composed of smooth muscle, physiological methods give the most direct approach. Yet the gross features of position, form and relationships with their range, modality and susceptibility to change are important enough to warrant quantitative and exact study also. In the education of medical students these features which after all, form the basis for our judgment of the abnormal, are all too often scamped or neglected. In taking up the work we have had a double object in view, namely, first to ascertain the range of variation in the alimentary tract of the white, healthy young male and secondly, to give our medical students the benefit of a really adequate education in the subject.

There is nothing original in this type of study. It has been undertaken many times before. But we have sought to give point to our observations by carefully arranging the time and conditions of the observations. The first study of the student is made immediately upon the commencement of the medical course, at the beginning of the freshman year. At this stage the student is still a layman without experience in medical work, with no background of medical study, without even the atmosphere of medical education to mitigate the feelings of the strangeness of this new sphere of work. We next take the same student after six months of the medical course, when the

* Concluding part of Caldwell Lecture, 1926.

[1] This is a brief report of the research carried out in 1924–26 by Miss Wilhelmine Kuenzel and the author. The full description of our records and our results will appear later.

physique which he built up during the summer before his new duties commenced has been subjected to the strain of a course of intensive training very different from that characteristic of the previous academic work. Again we examine the student at the beginning of his sophomore year after he has become immune to the sights, sounds and smells inseparable from medical education, when he is thoroughly at home in the medical school and has safely passed the barriers whch the first year's work inevitably throws across the path of freshmen.

TECHNIQUE OF ROENTGENOLOGIC OBSERVATION

It is our custom, aside from the roentgenoscopic examination, to make roentgenograms of the stomach ten minutes and sixty minutes respectively after the barium meal is swallowed. The meal consists invariably of 4 ounces of barium sulphate in 12 ounces of fresh buttermilk. It is taken between two and three hours after lunch during the afternoon. The amount of contents in the stomach when the barium meal is taken is small and negligible.

The vertebrae are counted from the sacral promontory upwards, the last free vertebra being styled the fifth lumbar. This is necessary because, after all, the true pelvis bears a fairly constant relation to the sacral promontory and all abdominal organs must dispose themselves with reference to the floor of the pelvis which is the lowest part of the abdominal cavity. In occasional students we find six rib-free vertebrae below the thorax but, in the absence of precise information regarding the number of pre-sacral vertebrae, we cannot assume that an extra element is present.

For practical purposes we divide the vertebrae into upper, middle and lower thirds. This subdivision gives three vertebral levels and one disc level of approximately equal vertical dimensions.

The tube is placed as nearly as possible opposite the disc between the second and third lumbar vertebrae at a distance of 25 inches from the vertical plate holder against which the student leans his abdomen. The current used is 30 milliamperes and, with a cassette, the exposure is 1½ to 2 seconds. By experiment we find that unavoidable variations in the relative position of the tube to the vertebral column may make a registration difference of not more than one of the vertical subdivisions or levels defined above. The extreme instrumental error is probably infrequent since, to obtain it, the tube must be raised or lowered the full 2½ inches called for in producing a stereoscopic roentgenogram.

The student is told to hold his breath midway between inspiration and expiration, this being found in practice to be the most satisfactory instruction. It gives more even results from student to student than the instruction to inspire or expire to the fullest degree.

Students have been examined in both vertical and horizontal postures but, unless otherwise stated, the following observations refer to the vertical posture.

POSITION OF THE STOMACH RELATIVE TO THE VERTEBRAL COLUMN. VERTICAL POSTURE

Charts have been prepared to show the relative positions of cardia, pylorus and lowest part of greater curvature in the student stomach for the year 1925–26. The number per year is about 36 but naturally, as a result of the educational casualties during the freshman year, this number is reduced to about 20 in the sophomore year.

On the charts each student is represented by a dot. The median in the series is circled, and the average level of each stomach point is indicated by the letter M. Sometimes the cardia is not shown on the roentgengrams since the film has been intended mainly to show relation of contents in stomach and small intestine.

The chart of the cardia (Fig. 1) shows that this part of the stomach is fairly constant in position throughout the hour and at different periods in the student's course. The indication for the site of the cardiac orifice is the horizontal lower level of the *Magenblase*. The average position of this is the lower third of the twelfth thoracic vertebra. The range is from the upper third of the eleventh thoracic to the lower third of the first lumbar vertebra. It is

worth noting that the lower levels are more characteristic of freshmen in October at the commencement of the medical course. Fuctuations of the average position on the chart are more apparent than real: the position of the median specimen clearly shows this: fluctuations of mean and median counterbalance each other.

The chart on the position of the pylorus (Fig. 2) shows a different result. In it the mean and the median are always on the same level. Changes in this level are therefore more to be relied on than those of the cardia. There is not much fluctuation of the average position but such as there is indicates some raising of the pylorus in the sophomore especially at the end of an hour after taking the barium. The freshman levels are the lower third of the third lumbar vertebra immediately after feeding, and the disc between the third and fourth lumbar vertebrae an hour after food. The slight difference between these two levels is certainly accidental. In sophomores the corresponding levels are the middle and upper thirds of the third lumbar vertebra.

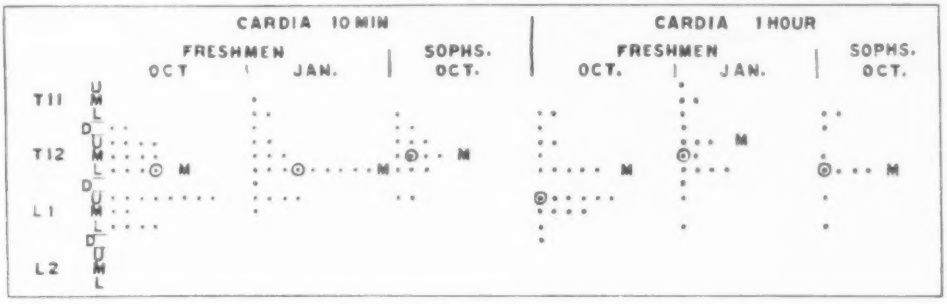


Fig. 1. Level of cardia, 1925–26.

The site is noted ten and sixty minutes after the barium meal is given. T11 means the eleventh thoracic vertebra. U, M, L, D specify upper, middle, lower part of vertebra, and disc respectively. M indicates average position. The encircled dot represents the median example in the series. The mode or most frequent position is shown by the longest series of dots. The series, though small, gives a good indication of average site which does not change more than one-third of a vertebra in successive years. This method of representation reduces to the smallest possible amount the differences in site. Differences of more than one-third of a vertebra are significant. In sophomores there is a slightly higher position of the cardia after an hour than in freshmen.

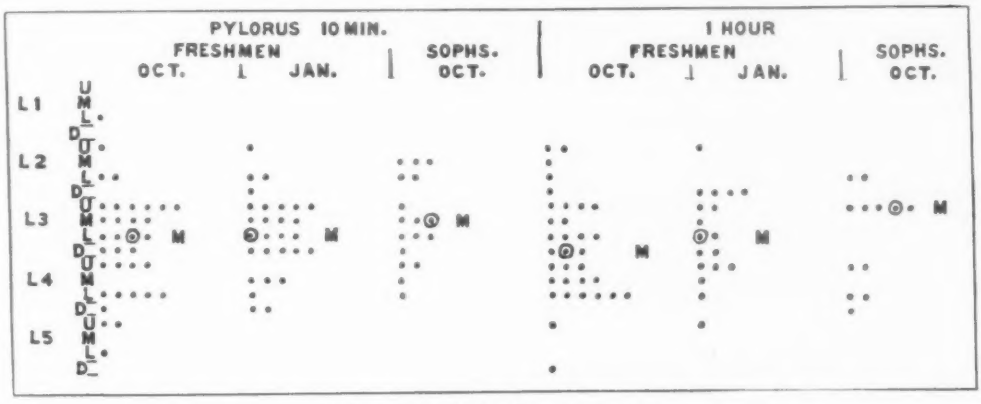


Fig. 2. Level of pylorus, 1925–26.

The pylorus is considerably higher in sophomores after sixty minutes than in freshmen. For general features see legend of Figure 1.

It is the greater curvature (Fig. 3) which shows most clearly on our roentgenograms the subtle influence of student confidence. Of course the method of averaging on the chart reduces this difference quite markedly but it exists clearly nevertheless.

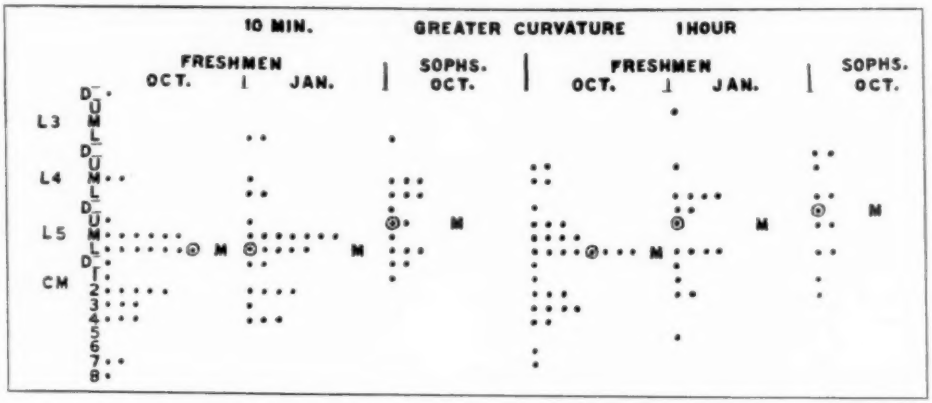


Fig. 3. Level of most dependent part of greater curvature (pyloric vestibule).
For general features see legend of Figure 1. In sophomores the greater curvature is distinctly higher than in freshmen at the end of an hour. With this higher position there is also a narrower gastric tube.

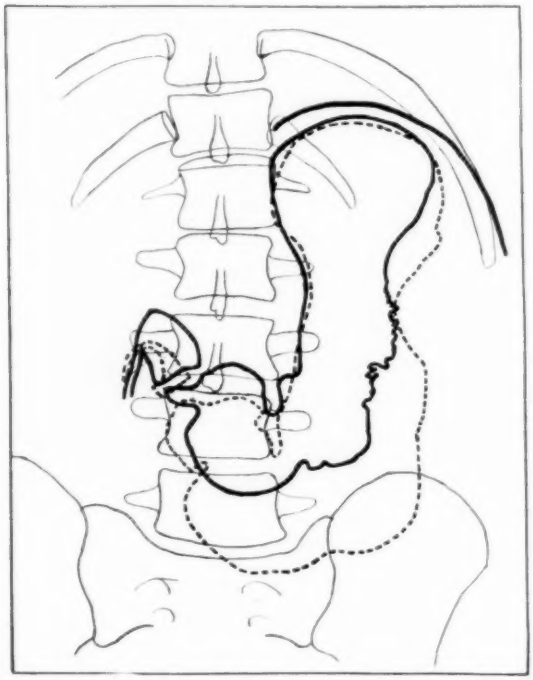


Fig. 4. Superimposed outline of stomach in freshman (broken line) and sophomore (solid line). Student 330 B, H.

These roentgenograms were taken one hour after the barium meal, early in October of freshman and sophomore years, under conditions as similar as it was possible to make them. Note that sites of cardia, fundus and pylorus remain practically constant. The gastric tube is narrower and the greater curvature higher in the sophomore. Both roentgenograms are from the same student, a quite typical example.

The October freshman level is the lower third of the fifth lumbar vertebra. The sophomore level is the upper third of this vertebra or even the disc below the fourth lumbar, although the latter level at the 60-minute stage is accidentally different from the 10-minute stage. In the freshman year the 10-minute January level is the same as the October level. But at the 60-minute stage the greater curvature is raised. Comparison of the ranges of greater curvature positions with pylorus positions demonstrates very well the raising of the greater curvature as the student passes through his freshman experience to the sophomore stage.

Even more striking than the raising of the greater curvature is the narrowing of the gastric tube, the long arm of the U, in the sophomore condition. Up to the present, however, we have been unable to devise a satisfactory method of charting this change.

The difference between freshman and sophomore stomachs lies in the raising of the greater curvature and the narrowing of the gastric tube rather than in emptying time or activity of contractions. Indeed, emptying time, while dependable within certain limits, is influenced by many accidental factors. It bears no relation to the amount of stomach contents. A student with but a mouthful or two of barium buttermilk mixture may still have as deep and extensive a barium shadow at the end of an hour as he had immediately after feeding. The peristaltic movements are normal but the barium passes out very slowly.

The time which students have to give to

this study and the daily period during which alone they can be examined preclude the taking of a six-hour roentgenogram. Hence we have no data upon the ultimate emptying time.

The marked difference between freshman and sophomore stomachs which is shown in the position of greater curvature both in pyloric vestibule and gastric tube is obvious in the roentgenogram taken immediately after the swallowing of the meal, but is better shown after a 60-minute interval. It is distinct and characteristic, and is accompanied by corresponding differences in transverse colon. We can account for it only by appealing to the essential features of the student's psyche at the beginning, of freshman and sophomore years. At the former date he is bewildered by this new environment, being plunged immediately into the dissecting room and roentgenographic laboratory; he comes to the screen often in a cold perspiration, fearful or at least apprehensive of the unknown ordeal through which, without proper understanding, he is called upon to pass. The sophomore, on the other hand, knows all about the work, coöperates willingly, even eagerly; is keen to see the result of the comparison between his last year's alimentary tract and his present condition; has confidence in his instructors with whom he is now on very friendly terms without a trace of that distant feeling characteristic of the freshman year. He is immune to all the conditions of his life as a medical student and has had a thorough training in roentgenographic technique and observation.

This study therefore throws much light upon the observation of patients who, of course, are in the position of the freshman. The roentgenographic appearance of their alimentary tract is by no means necessarily a true picture of their actual condition and must be discounted far more heavily than has hitherto been the custom generally by physicians who, like ourselves, have the responsibility of interpreting roentgenograms. The physician who has not himself seen the patient at the time of roentgenography or who has not himself screened the patient, is in no position to interpret with confidence the roentgenograms set before him, unless they show actual deformation, the result of disease which can be demonstrated anatomically rather than physiologically.

THE RELATIONSHIP OF ILIAC CREST TO VERTEBRAL COLUMN

For roentgenoscopic examinations the iliac crest is the most readily available landmark and may well form the basis of determination of stomach position. It has been taken for granted that the crest lies on

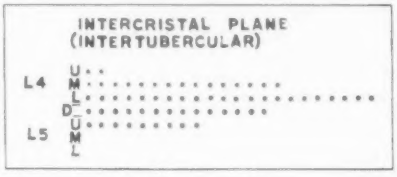


Fig. 5. Level of intercristal plane, 1925–26.

This figure indicates the fairly uniform position of the line joining the highest points of the iliac crests (roentgenographic) upon the vertebral column. The great majority of white young males show the line between the middle of fourth lumbar vertebra and the disc beneath it.

the level of the disc between the fourth and fifth lumbar vertebrae, an assumption which, though approximately correct, may be quite misleading. R. O. Moody[1] in his type diagrams (R. O. M., Figs. 16 and 17) assumes this relationship but his actual roentgenogram (R. O. M., Fig. 5) shows the iliac crest at the level of the lower third of the fourth lumbar vertebra. This is the position which we find most commonly, the range being from upper third of fourth lumbar to upper third of fifth lumbar vertebra. Indeed more students show the crest opposite the fourth lumbar vertebra than in all other positions added together (Fig. 5).

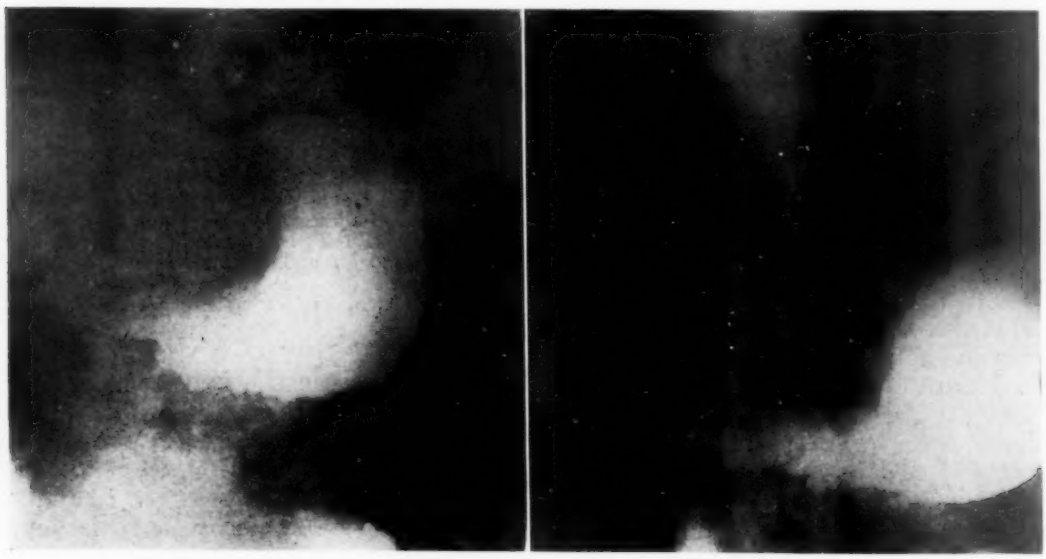
In plotting out the position of the stomach relative to the vertebral column from roentgenoscopic tracings it is essential to get correct the relationship of iliac crest to vertebrae, for upon the interpretation of this basal relationship depends the stomachic levels as recorded from roentgenoscopic examination.

For example, I have plotted the relationship anew on one of Moody's illustrations so that it is in the most usual position in Reserve students and also incidentally in

the relationship shown in Moody's roentgenographic illustration. The whole position of the stomach in the abdomen is in consequence altered. The pylorus is now opposite the upper third lumbar vertebra by Moody's own records instead of opposite the disc below the third lumbar vertebra as it would appear to be from Moody's description. Thus, the position of pylorus on the vertebral column becomes the same in Moody's sample as in our sophomore sample. Many years ago I worked out the largely an expression of the state of the stomach musculature. What change from vertical to horizontal posture really does is to raise all parts of the organ, including the cardiac orifice, by the height of one vertebra, occasionally by the height of two vertebrae (Fig. 6).

THE DUODENAL OUTLINE

The duodenal cap is not always shown and, if apparent, it is not always regular in outline. Indentations upon its contour



A B

FIG. 6. Typical example of effect of posture on stomach. Student 215, A, B. Roentgenograms taken in January of freshman year.

A. Vertical position ten minutes after meal. Cardia at lower border of T.XII: pylorus at middle of L.III: greater curvature at middle of L.IV.

B. Horizontal position twenty minutes after meal. Cardia at lower border of T.X: pylorus at middle of L.I: greater curvature at middle of L.II.

modal or most frequent position of the pylorus in the English working class as opposite the disc above the third lumbar vertebra.[2] For the cause of this divergence in position we must look to the sample if not also to the social class from which the patients were drawn.

INFLUENCE OF POSTURE ON THE STOMACH POSITION

Examination of the student in vertical and horizontal positions shows that the actual shape of the stomach does not change. The shape is partly the result of relationship to other abdominal organs but are sometimes plainly due to gas pockets and these may readily remain unchanged for hours. Beyond the cap is a narrowed portion which has been called by some authors the area of duodenal sphincter. In this area there are no indentations caused by plicae circulares. Anatomically it is found that the narrowed part terminates at or just above the entrance of the common bile duct where plicae circulares commence. Then follows a much more capacious lumen notched freely by plicae. This appears on the roentgenogram or screen as a broad notched barium shadow. It comprises the lower half of the second or

descending part of the duodenum and the horizontal or third part as far as the site of crossing of the mesentery.

This is the site of so-called duodenal stasis. While it is not the intention of the writer to deny duodenal stasis with its serious consequences, we do want to point out most emphatically that pseudostasis is not uncommon in the normal healthy subject. We have met with it in students who are in perfect condition. Sometimes it is quite temporary, lasting only a short while; sometimes it is present throughout the hour. Many students can produce temporary stasis by voluntarily contracting the abdominal wall and raising the viscera. When the effort is relaxed the stasis ceases. When stasis of longer duration occurs it is due to temporary constriction of the duodenum, not by weight of small intestine pulling on the mesentery, but by gas in the gut, often in the transverse colon causing an indirect pressure on the duodenum. This itself is one result of subconscious nervousness (Figs. 7A and 7B).

The fixation of the lower second (vertical) part of the duodenum to the dorsal abdominal wall is easily noted on the screen. The patient can alter the position of the pylorus at will by contracting his abdominal musculature. By raising the pylorus and duodenal cap the higher duodenum can be straightened out, whereas normally it forms an inverted U-tube. When this is done the barium can be seen travelling downward from the cap in a long thin stream until it reaches the more dilated duodenum below the entrance of the common duct.

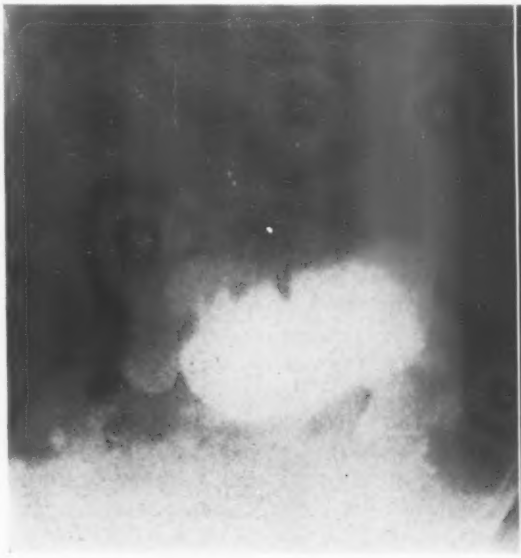


FIG. 7A. Typical freshman duodenal pseudostasis. Student 225,B. One hour after the meal, January, 1925. The stasis lasted more than two hours and the effect on stomach contents can be observed by comparison with Figure 7B.

FIG. 7B. Absence of duodenal pseudostasis in sophomore year. Student 225,G. One hour after the meal, October, 1925. There is now no pressure by the stomach upon the third part of the duodenum. Contrast Figure 7A.

POSITION OF JEJUNAL AND ILEAL COILS

More than twenty years ago Monks[3] gave an account of intestinal localization which has, ever since, been the standard work on the subject. It describes the usual position of the small intestine in the adult as seen in the operating room. This disposition is the same as that found at autopsy and in the dissecting room. Briefly the disposition is the following: Of the jejunoileum the highest coils are found on the left side above the attachment of the mesentery; succeeding coils are distributed, the higher ones to the right of the mesenteric attachment, the lower to the left. The terminal coils are in the pelvis and right

iliac fossa below the attachment of the mesentery. This arrangement is indeed subject to change, many adults being found with the bowel disposed, as in children and fetuses, more simply, in ladder coils.

In Monks' distribution, only the lower coils of ileum are in the pelvis, the rest of the small intestine being in the abdomen itself above the pelvis. Forty years ago, however, Sir Frederick Treves,[4] in his Hunterian lectures, described coils of jejunum in the pelvis. We have had ample opportunity of observing the site of the jejunum and ileum in the student. It is invariably disposed in ladder coils like those typical of intestinal obstruction, whenever the arrangement can be traced after barium meal (Fig. 8). We have carefully investigated the disposition of small intestine in other students where the arrangement was more obscure and we have never found any evidence of the arrangement described by Monks. Hence we conclude that Monks' description, undoubtedly the modal arrangement in operating room and cadaver, is to be looked upon as an artefact, the result of anesthesia or death just as we now recognize the shape and position of the stomach under similar conditions to be an artificial consequence of anesthesia or death.

Fig. 8. Position of coils of small intestine in vertical posture. Student 333, H.

Roentgenogram taken in October of sophomore year, one hour after barium meal. Whenever the coils of small intestine can be traced in the roentgenogram or on the roentgenoscopic screen, they are always found as ladder coils, below the stomach and largely in the pelvis, not in the arrangement described by Monks.[3] Occasionally one loop lies above the level of the pylorus.

Further we invariably find the small intestine lying in the lower abdomen and true pelvis. In occasional instances only, even in the horizontal posture, is there a loop or two, never more, above the level of the pylorus. The high position of the proximal coils of jejunum near the diaphragm in the operating and dissecting rooms is entirely unlike that found in normal life.

The peristaltic wave in the small intestine progresses at widely diverse rates of speed. It may be so fast that one can see only the progress of the greatly diluted barium in the upper bowel by submitting serial roentgenograms to cinematographic treatment. It is so slow in the lower ileum, when there is spasm of the transverse colon, that one cycle of peristalsis takes half an hour for its completion. This phenomenon will be further discussed under the heading "character of the transverse colon."

THE DISPOSITION OF THE LARGE BOWEL

The normal low position of the transverse colon is now well recognized. The mobility of cecum and of both hepatic and splenic flexures must be emphasized and also the occurrence, in the living, of a special loop at the beginning of the transverse colon known to the French as the hepatic loop.

In spite of the fact that a mesocolon is present in only one individual out of three either in ascending or descending colon,[5] the absence of a mesocolon is no deterrent to the low position or mobility of these parts of the bowel. Change in posture from the vertical to the horizontal raises these flexures as it does the stomach.

CHARACTER OF THE TRANSVERSE COLON

The transverse colon is subject to as much change in character as is the stomach.

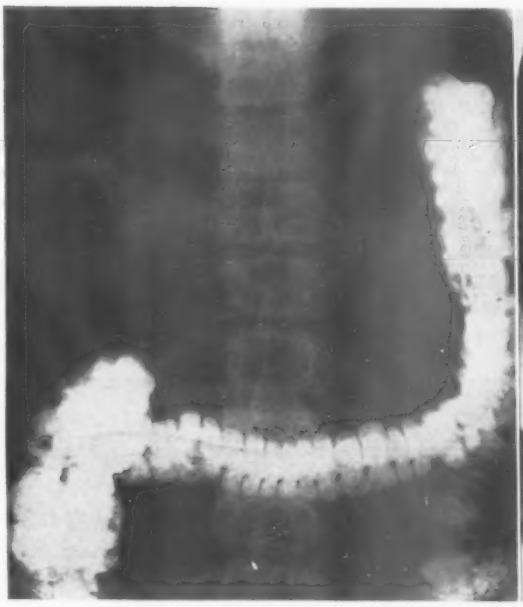


FIG. 9A. Roentgenogram of normal colon (Series No. 2, No. 89, 2:28 P.M. March 4, 1926).

Twelve hours after barium meal. Note the well-filled large haustra in contrast with Figure 9B.

FIG. 9B. Roentgenogram of the same colon in spastic condition nine hours after barium meal (Series No. 1, No. 30, 11:15 A.M. Feb. 22, 1926).

There is delay in the passage of contents although the column head has reached the same site in both roentgenograms. Note the small pinched and apparently unchanging haustra. Contents do pass along the transverse colon although very slowly.

Whereas, however, it is characteristic of the freshman stomach to be atonic in position though not in movement or emptying time, under observation on the screen or while a roentgenogram is being taken, it is equally characteristic of the transverse colon to be spastic in part or throughout. This spasticity is the result of a subconscious anxiety or strain and probably develops in us all from time to time (Fig. 9). Spasticity is not observed in the sophomore bowel because the student is then undisturbed by the roentgenographic procedure.

We have had the opportunity to study intensively the spastic condition of the transverse colon. No change occurs in the anatomical configuration of the bowel when roentgenographed every two minutes for an hour, in spite of the fact that the cecum is distending under pressure from the ileum. We have also noted that under such circumstances the peristaltic wave in the lower ileum may be extremely slow, a single cycle of peristalsis taking half an hour to complete its phases and pass contents on into cecum and ascending colon.

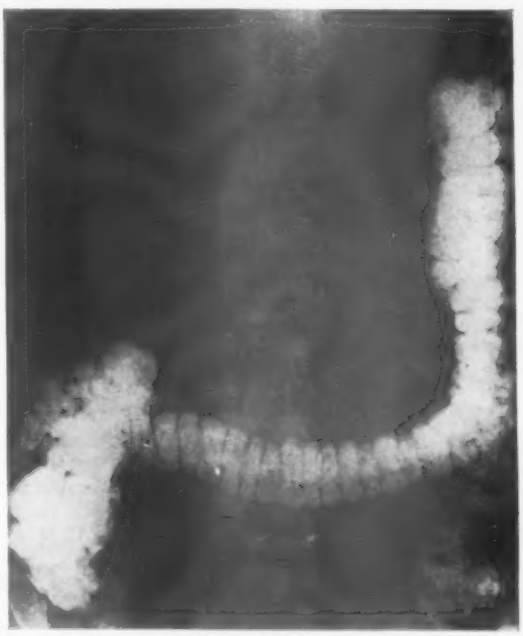


FIG. 10. Normal colon (Series 2, No. 78, 2:06 P.M. March 4, 1926).

A wave of peristalsis is passing over the bowel showing contraction phases in front of vertebral column in the horizontal part of the colon near the angle with the vertical part.

MOVEMENT IN THE PROXIMAL COLON

The proximal colon is defined as that part of the large bowel extending from cecum to splenic flexure.

We have observed the cecum and ascending colon during filling. There is a slow peristaltic wave which passes over both parts of the bowel with alternate definition and obscuration of haustra. We have not seen antiperistalsis. By taking successive roentgenograms at intervals of two minutes and submitting these to cinematographic treatment the method of filling and contraction is rendered apparent.

By the method just described we have also observed the same peristaltic wave in the transverse colon (Figs. 10, 11 and 12). The slow progress of peristalsis modifies but does not obliterate the haustra. One should regard the bowel outline as one would the jejunum with its plicae. That means the haustra should be ignored for the peristaltic wave passes over them and makes but secondary use of them. Changes in haustral configuration are accessory to the peristaltic wave. We have, further, observed on the roentgenoscopic screen the progress of the peristaltic wave. It is apparent most definitely in a bowel of which the haustra are sufficiently separate to be observed without abdominal pressure by the hand. Such pressure temporarily inhibits peristalsis. The wave progresses at about half the speed of peristalsis in the stomach. We have not seen anastalsis, that is, reversed peristalsis. Nor have we seen mass movement as described by Barclay and Holzknecht. Our conclusion is that contents are moved

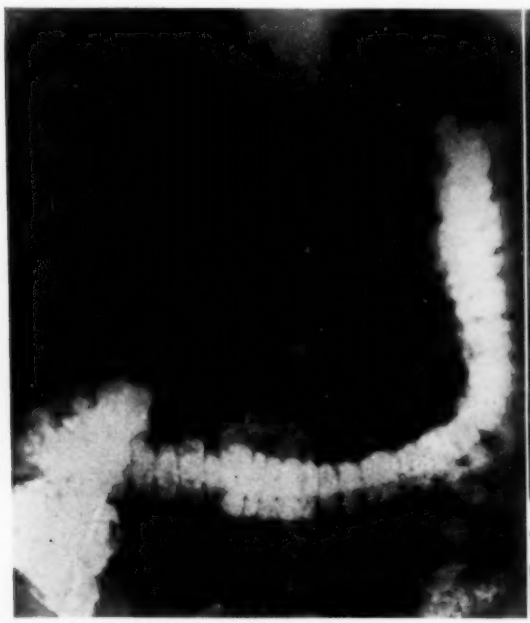


FIG. 11. Normal colon (Series 2, No. 79, 2:08 P.M. March 4, 1926).

The phases in Figure 10 are replaced by a well-marked contraction wave in the transverse colon immediately to the right of the vertebral column near the hepatic loop. There is some subdivision of haustra near left extremity of the horizontal part. This indicates peristaltic activity but not a well-defined wave.

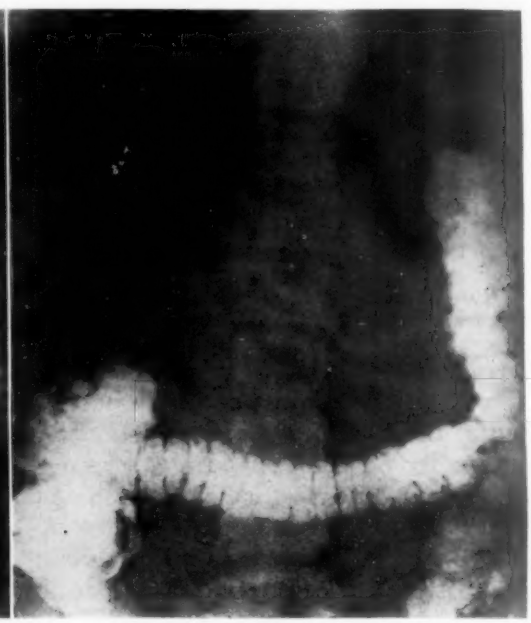


FIG. 12. Normal colon (Series 2, No. 80, 2:10 P.M. March 4, 1926).

A new wave is starting close to the beginning of the transverse colon. To the left of the vertebral column is an area of narrowed haustra which is characteristic of the passage of a peristaltic wave. It is only by the successive presentation of serial roentgenograms in cinematographic series that one can obtain convincing evidence of the peristaltic wave, apart from watching it on the roentgenoscopic screen.

FIGS. 10, 11 and 12. The peristaltic wave in the transverse colon.

This involves but does not obliterate the haustra. It can be followed by the naked eye and has about half the speed of stomachic peristalsis.

along the proximal colon by slow peristalsis in precisely similar fashion to the movement already recognized in stomach and small intestine.

In conclusion, our thanks are due to the enthusiastic collaboration of the many students, both freshmen and sophomores, by whose cheerful coöperation this study could alone be carried out.

SUMMARY

1. The study of the normal alimentary tract in health of young male students affords a criterion for observation of pathological condition.

2. All parts of the tract are exceedingly sensitive to emotional or nervous conditions. These influence different parts of the tract in divers directions. The stomach becomes atonic in outline though not in movement nor in emptying time. The duodenum shows pseudostasis. The transverse colon exhibits a spasm which may absolutely inhibit the onward passage of contents.

3. The sites of cardia and pylorus are affected in similar manner though not so greatly as are the positions of the greater curvature in the pyloric vestibule and gastric tube.

4. The normal position of the small intestine in the living, whether upright or horizontal, is in the lower abdomen and true pelvis: its disposition is in ladder coils.

5. Peristalsis in the lower ileum may be exceedingly slow in spasm of the transverse colon, one wave taking half an hour to complete its cycle.

6. The proximal colon (cecum, ascending colon, transverse colon) exhibits a peristaltic wave like those of the stomach and small intestine. Its rate of progress in the transverse colon is about half that of stomachic peristalsis.

REFERENCES

1. Moody, R. O., van Nuys, R. G., and Chamberlain, W. E. Position of the stomach, liver and colon; results of roentgenologic study in 600 healthy adults. *J. Am. M. Ass.*, 1923, lxxxi, 1924–1931.
2. Todd, T. W. The Clinical Anatomy of the Gastro-intestinal Tract. London, 1915.
3. Monks, G. H. Intestinal localization. *Tr. Am. Surg. Ass., Phila.*, 1903, xxi, 405.
4. Treves, F. The anatomy of the intestinal canal and peritoneum. *Brit. M. J.*, 1885, i, 415; 470; 527; 580.
5. Smith, G. M. A statistical review of the variations in the anatomic positions of the caecum and the processus vermiformis in the infant. *Anat. Record*, 1911, v, 549–556.

CHOLECYSTOGRAPHY—A METHOD OF ORAL ADMINISTRATION OF SODIUM TETRAIODOPHENOLPHTHALEIN WITHOUT THE USE OF CAPSULES OR PILLS

BY JOHN S. SPROULL, M.D.

Hale Hospital

HAVERHILL, MASSACHUSETTS

THE discovery by Graham, Cole and Copher that the administration of sodium tetraiodophenolphthalein renders the bile in the gall-bladder opaque to roentgen rays and thus makes possible the routine visualization of that organ, has revolutionized gall-bladder diagnosis.

The ready acceptance of their facts and their deductions therefrom is an evidence of the urgency of the need that existed prior to their work, and the continued and increasing use of their methods is a tribute to the completeness and scientific value of their discovery.

The two methods of administration of the dye which are used at the present time are the intravenous and the oral. The oral method is probably in much more common use than the intravenous. For this there are several reasons.

1. It is the natural method of taking food or medicine into the system in man.

2. It is easy and simple.

3. It does not require any surgical precautions or call for special surgical skill.

4. It requires no hospitalization of the patient.

It is customary in the oral method to administer the dye in capsules or pills. The capsules in use are plain gelatin capsules, keratin coated capsules or formalin hardened capsules; pills are used with some coating on them.

The object is to administer the dye in some protected form which will prevent its coming in contact with the gastric juice and yet will readily permit its contact with the alkaline juices of the intestine from which it is presumably absorbed.

Graham[1] states, referring to the oral administration of the dye: "It is necessary that any of these substances should be protected against the action of the gastric juice, because the hydrochloric acid of the stomach converts the soluble sodium salt into the insoluble free acid which will then not be absorbed. For purposes of protection various capsules and coatings have been devised."

That these various capsules and coated pills often pass through the gastrointestinal tract undissolved is a matter of frequent observation, so much so that in some clinics it is a routine either to take a preliminary roentgenogram of the abdomen or to roentgenoscope the abdomen before beginning the gall-bladder examination to assure the roentgenologist that the capsules or pills have dissolved.

After a rather trying experience with plain gelatin capsules which passed through the gastrointestinal tract without dissolving, the writer was constrained to try its administration in food. For this purpose a cereal was selected and cream of wheat was found most appropriate. The description and understanding of this method may be facilitated by considering the details under various headings.

1. *Dosage.* In the beginning each patient received 4 gm. of the dye, no consideration being given to the variation in body weight of the patients. Later it was found that a dosage of 2 gm. given to patients of 150 pounds or under, and a dosage of 3 gm. to patients over 150 pounds was sufficient to get good roentgenograms. Further developments suggest that even this dosage may be reduced.

2. *The Method of Administration.* No special meal to empty the gall-bladder is advised and no cathartic preparation given. The dye is dispensed to the patient in plain gelatin capsules each containing 0.5 gm. of the dye, and at the same time the patient receives a printed or written card with the following directions: Take no medicine to move the bowels. Eat the evening meal as

[1] Graham, Evarts A. New developments in our knowledge of the gall bladder. *Am. J. M. Sc.*, 1926, clxxii, 625–643.

usual if desired. At 8 P.M. add all of the medicine contained in these capsules to 4 (or 6) tablespoonfuls of cooked cream of wheat (cold). Mix thoroughly and add syrup to flavor. Eat the whole at 8 P.M. Drink water freely until midnight, but do not eat anything after the cream of wheat. After midnight do not eat or drink. Report at the *x*-ray at 8 o'clock the next morning.

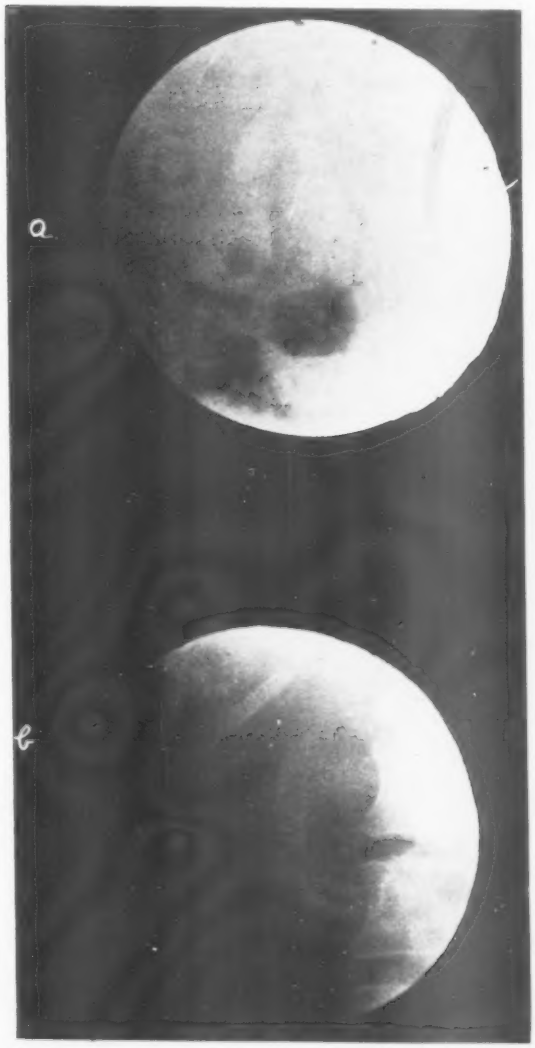


FIG. 1. *a*. Normal gall-bladder. Weight of patient 110 lbs.; 2 gm. tetraiodophenolphthalein in cream of wheat.

b. Normal gall-bladder. Weight of patient 105 lbs.; 2 gm. tetraiodophenolphthalein in cream of wheat.

3. *Technique.* At 8 A.M. films are taken and the patient is dismissed until 1.30 P.M. with instruction to continue the fast from food and drink. At 1.30 P.M. the second series of films are taken, after which the patient is advised to eat a meal rich in fats, usually a dropped egg on buttered toast, a pudding with cream, and a cup of cocoa with cream, and to report two hours after for a third film.

FIG. 2. *a*. Normal gall-bladder. Weight of patient 171 lbs.; 3 gm. tetraiodophenolphthalein in cream of wheat.

b. Normal gall-bladder. Weight of patient 140 lbs.; 2 gm. tetraiodophenolphthalein in cream of wheat.

4. *Results of the Method.* Twenty-three

cases were studied in the writer's private laboratory and excellent shadows of the gall-bladder were obtained in twenty-one. One of the two cases presenting no shadow was submitted to surgical exploration and was found to have a stone the size of a cherry blocking the cystic duct, so it was evident that the roentgen examination was satisfactory in this case and that the report of no shadow seen was not due to failure of the method employed.

The other case showing no shadow of the gall-bladder has symptoms suggesting severe cholycystic disease, but as yet has not submitted to surgical exploration.

The individual body weight of the patients varied from 105 to 226½ pounds.

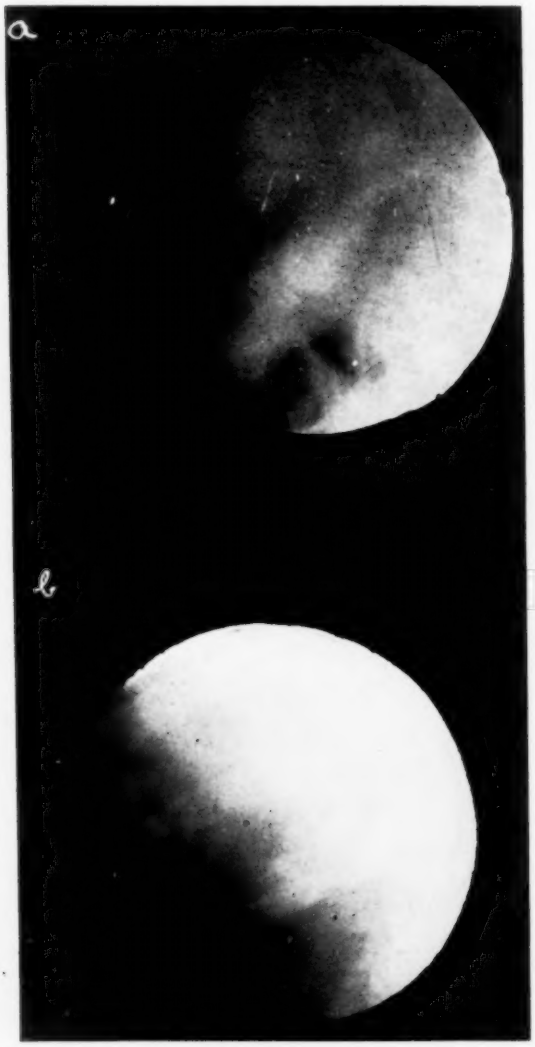


Fig. 3. *a*. Normal gall-bladder. Weight of patient 171 lbs.; 3 gm. tetraiodophenolphthalein in cream of wheat.

b. Normal gall-bladder. Weight of patient 151 lbs.; 2.5 gm. tetraiodophenolphthalein in cream of wheat.

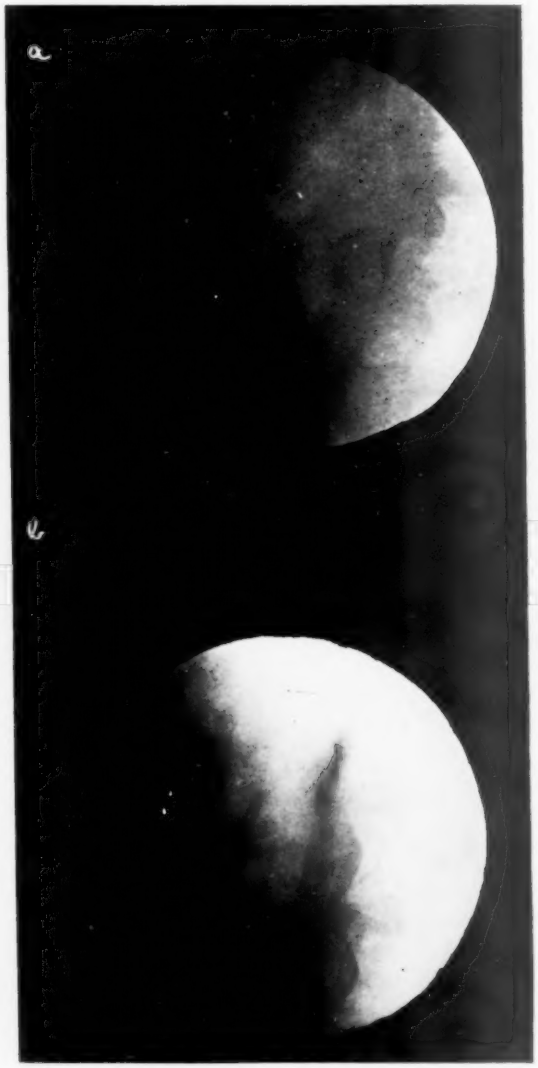


Fig. 4. *a*. Normal gall-bladder. Weight of patient 130 lbs.; 2 gm. tetraiodophenolphthalein in cream of wheat.

b. Normal gall-bladder. Weight of patient 128 lbs.; 2 gm. tetraiodophenolphthalein in cream of wheat.

5. *Reactions*. Three patients complained of nausea. Two vomited a little. Three had slight diarrhea. None were seriously inconvenienced.

6. *Advantages of the Method.*

(*a*) No consideration need be given to the question of undissolved capsules or pills.

(*b*) Satisfactory shadows can be obtained with smaller doses of the dye than those usually given by other methods. This is probably due to the dilution of the dye by the cereal thus spreading it over a larger surface of the gastrointestinal mucosa and thus permitting its more ready and complete absorption. The writer has noted that very much less of the dye appears unabsorbed in the gastrointestinal tract than in other methods.

(*c*) There is less reaction on the part of the patient. The writer feels confident that those patients to whom the dye is administered in cereal complain of less reaction than when it is given in capsules or pills.

7. *The Difficulties of the Method.* In the 23 cases studied a few objected (some strongly) to eating a blue colored cereal. So far no patient has refused to coöperate by refusing to take the dye by this method and in each of 3 cases the test was performed three times and in 2 other cases the test was performed twice on each case. Not any of these 5 patients registered any serious objection to the repeated taking of the dye.

8. *Conclusions and Comments.*

(*a*) It is clearly demonstrated that perfectly good roentgenograms of the gall-bladder may be obtained by this method of administering the dye free into the stomach without being contained in any protective covering like capsules or pills. This conclusion would appear to be at variance with the theory that the sodium salt coming into contact with the hydrochloric acid of the gastric juice is converted into an insoluble acid and thus rendered incapable of absorption. It is possible that some future explanation may reconcile these two apparently conflicting facts.

(*b*) The method presented is simple and feasible and the resulting diagnostic shadows of the gall-bladder compare favorably with those taken by other oral methods, and at the same time some of the causes of dissatisfaction by the other methods of oral administration are eliminated.*

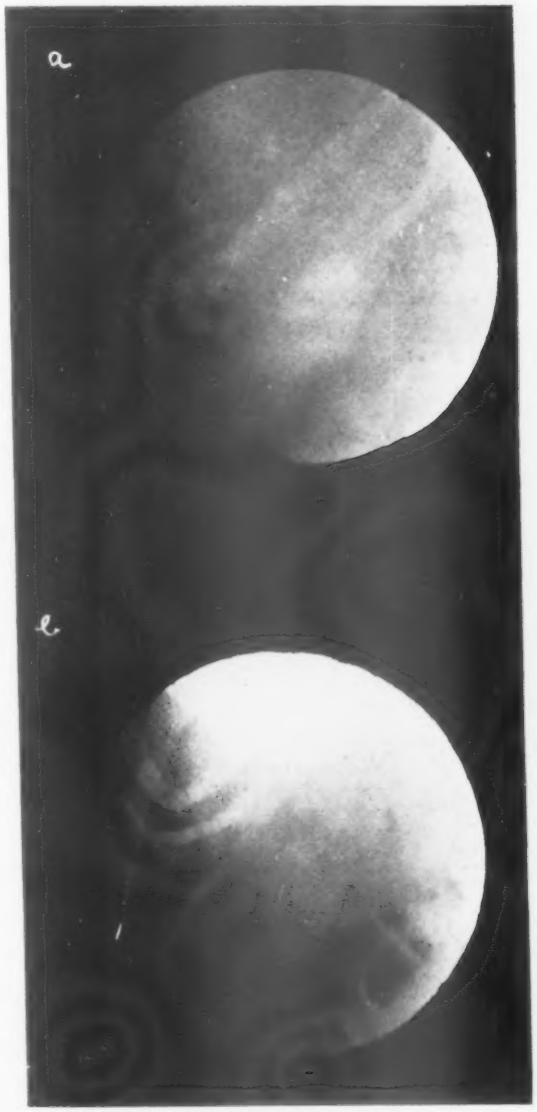


Fig. 5. *a.* Normal gall-bladder. Weight of patient 135 lbs.; 2 gm. tetraiodophenolphthalein in cream of wheat.

b. Pathological gall-bladder with stones. Gall-bladder large, shows mottling. At operation sixteen stones found. Pathological report chronic cholycystitis. Dose 2 gm. tetraiodophenolphthalein in cream of wheat.

* A number of cases not included in this report have been examined satisfactorily by this method in the Roentgen Department of the Massachusetts General Hospital, Boston, under the direction of Dr. George W. Holmes, chief of the department. It was thought best, however, to confine this report to those cases studied under the direct supervision of the writer.

THE PINEAL SHADOW AS AN AID IN THE LOCALIZATION OF BRAIN TUMORS*

BY JACOB H. VASTINE, M.D., AND KENNETH K. KINNEY, M.D.

PHILADELPHIA, PENNSYLVANIA — WILLIMANTIC, CONNECTICUT

IT has long been known by the histologist that the pineal gland frequently contains calcareous deposits—the significance of this we are not prepared to discuss. Our chief concern in this report is the fact that in a majority of adults the calcareous deposits render the gland opaque to roentgen rays and therefore cast a shadow upon the film. When this shadow was first noted by roentgenologists, it was misinterpreted as being indicative of a pathological process—probably a tumor. As technique was improved this was found to be a normal occurrence. In reviewing the skull films of 616 cases we have found sufficient calcification to visualize the pineal gland in the following percentages:

Age in Years	Number of Cases	Percentage of Pineal Glands Visualized
Below 10	9	0
10–20—Female	32	18
Male	42	19
20–30—Female	63	39
Male	58	56
30–40—Female	58	44
Male	67	67
40–50—Female	65	57
Male	88	63
50–60—Female	40	52
Male	53	60
60 plus Female	16	68
Male	25	80
Total	616	
Average		47.9
Per cent over the age of 20 years in which pineal gland was visualized		59.2
Per cent of females in which pineal gland was visualized		46
Per cent of males in which pineal gland was visualized		58

The frequency of visualization of the pineal gland is dependent upon the technique employed—the better the films, the more frequently the pineal gland is seen.

The choroid plexus occasionally contains calcareous deposits and the shadow may be confused with the pineal gland. These, however, are readily distinguished in the stereoscope as being bilateral in the majority of cases, and as lying on either side of the midline in symmetrical positions.

Schüller[1] in 1918 suggested the value of the displacement of the pineal shadow in diagnosing intracranial lesions and cited one case of lateral displacement. In 1925 Naffziger[2] cited several more cases in which the pineal gland had been displaced *laterally*. It is our purpose to estimate the value not only of the lateral displacement but also of anteroposterior and vertical displacement as an aid in diagnosis. In endeavoring to establish a normal variation in position of the pineal gland, we examined a series of approximately 350 skull films essentially negative for intracranial lesions. Two hundred of the films showed calcification of the pineal gland.

METHOD

Measurements were taken, as shown in Figure 1 from the pineal gland to:

(1) The inner table of the frontal bone at its most distant point.

(2) The inner table of the occiput at its most distant point.

(3) The inner table of the vault.

(4) The level of the base of the skull.

In Chart 1 the measurement of the distance from the pineal gland to the inner table of the frontal bone was plotted against the sum of the distances from the pineal shadow to the frontal bone and to the occiput—this sum is approximately equal to the greatest anteroposterior diameter of the skull. The pineal glands of normal skulls were found to lie between the lines *a-a'* and *b-b'* which we considered the normal anteroposterior variation in position.

In Chart 2 the measurement from the pineal gland to the inner table of the vault was plotted against the sum of the distances from the pineal gland to the inner table of the vault and to the level of the base of the skull—this sum is approximately equal

* From the Department of Roentgenology, Peter Bent Brigham Hospital, Boston, Mass. Read before the New England Roentgen Ray Society, March 19, 1926.

to the vertical diameter of the skull. The pineal glands of normal skulls were found to be between the lines of *c-c'* and *d-d'* which we considered the normal vertical variation in position.

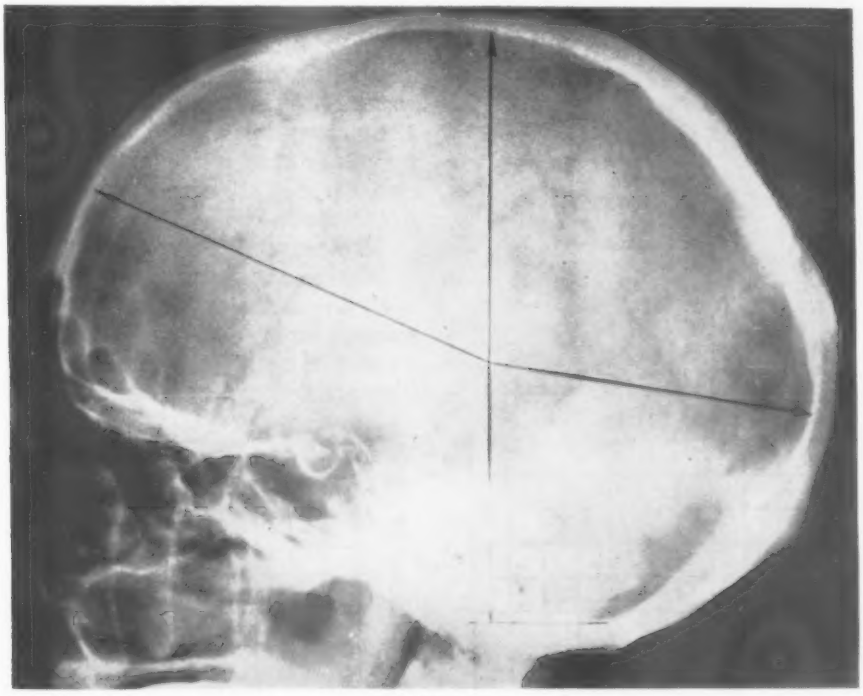


FIG. 1.

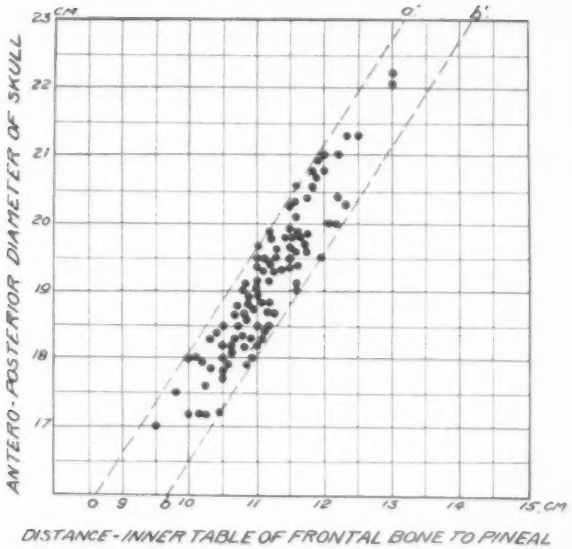


CHART 1.

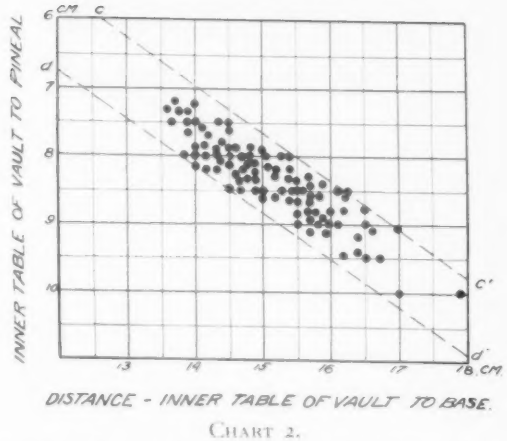


CHART 2.

Having thus established our normal curve it was considered that any pineal shadow lying to the left of the line *a-a'* was displaced anteriorly and to the right of *b-b'* was displaced posteriorly, and any pineal shadow lying above the line *c-c'* was displaced upward and any below the line *d-d'* was displaced downward.

ANTEROPOSTERIOR AND VERTICAL DISPLACEMENT

In order to estimate the value of pineal displacement we studied the skull films of

268 cases of verified brain tumors of which 163 showed calcification of the pineal gland. Classifying them both as to location and as to histological types, they were grouped as follows:

	Cases	
A. Frontal	35	1. Gliomas—18 2. Meningiomas—17
B. Temporal	15	1. Gliomas—13 2. Meningiomas—2
C. Parietal	21	1. Gliomas—13 2. Meningiomas—8
D. Occipital	9	1. Gliomas—2 2. Meningiomas—7
E. Subtentorial	44	1. Gliomas—15 2. Meningiomas—1 3. Acoustic neuromas—28
F. Pituitary	29	1. Cranio-pharyngeal pouch tumor—1 2. Pituitary adenomas—2

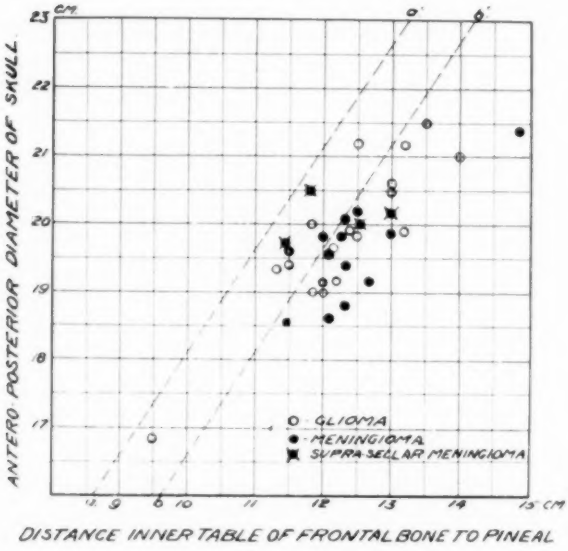


Chart 3.

A. Frontal Tumors (see Chart 3). (Pineal shadows lying to the right of the line *b-b'*, the posterior limit of normal, are considered to be displaced posteriorly.) Of the 35 frontal tumors, 25 or 71 per cent showed posterior displacement of the pineal gland and 3 cases, in which the lesion was unusually large, showed downward displacement as well. Of the 18 gliomas, 13 or 72 per cent displaced the pineal gland. Of the 17 meningiomas, 12 or 70 per cent did likewise.

B. Temporal Tumors. Of the 15 cases, 6 or 40 per cent had the pineal shadow displaced posteriorly and in one case where the tumor was low in the temporal region the pineal gland was pushed upward as well.

C. Parietal Tumors (see Chart 4). (Pineal shadows lying below the line *d-d'*, the lower limit of normal, are considered to be displaced downward.) Of the 21 cases of parietal tumor, 10 or 47 per cent displaced the pineal downward. Of the 13 gliomas, 5 or 38 per cent and of the 8 meningiomas 5, or 62 per cent, displaced the pineal gland downward.

D. Occipital Tumors (see Chart 5). (Pineal shadows lying to the left of the line *a-a'*, the anterior limit of normal, are considered to be displaced anteriorly.) Of the 9 cases of occipital tumors, 4 or 44 per cent displaced the pineal gland anteriorly. Of

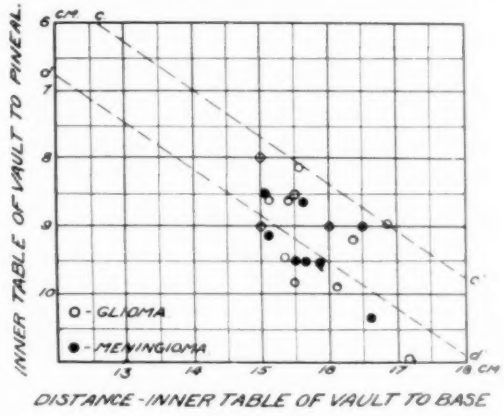


Chart 4.

the 7 gliomas, 3 or 43 per cent, and of the 2 meningiomas, 1 or 50 per cent did likewise.

E. Subtentorial Tumors (see Chart 6). Of the 15 cases of gliomas, 5 or 33 per cent had slight upward displacement of the pineal gland. One meningioma in the cerebellar region was seen in which the pineal shadow was displaced upward. Of the 28 cases of acoustic neuromas studied, 6 or 22 per cent had the pineal gland displaced upward.

Hydrocephalus. There were 15 cases of internal hydrocephalus reviewed in which the tumor itself was deemed too small to cause any displacement of the pineal gland by direct pressure and in only 2 or 13 per cent of these was the pineal shadow displaced upward.

F. Pituitary Lesions. There were 28 cases reviewed of which only 3 cases had the pineal gland displaced posteriorly—in 2 of

these cases the posterior clinoids were completely destroyed, probably indicating a very large growth, or an intracranial extension of the tumor. The cranio-pharyngeal pouch tumors (suprasellar cysts) have been considered under this heading. Patients with this type of tumor are generally seen before adult life and hence the pineal gland is not visualized—one case was seen, however, in which the pineal shadow could be visualized and it was displaced posteriorly.

A case in which there was an aneurysm of the basilar artery measuring approximately 4 cm. in diameter had definite upward displacement of the pineal gland.

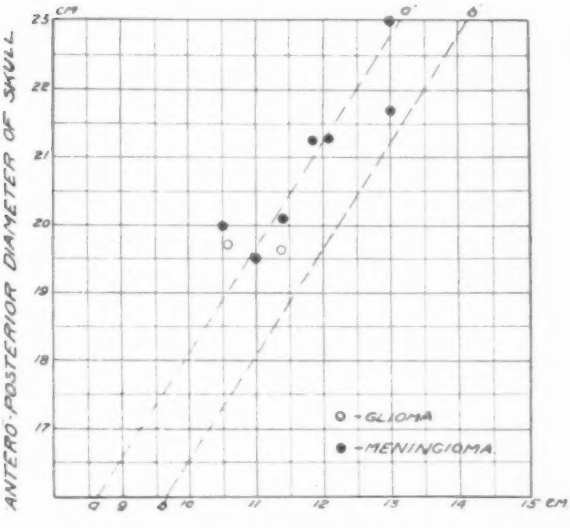


Chart 5.

LATERAL DISPLACEMENT OF THE PINEAL GLAND

The position of the pineal shadow in the midline, or lateral displacement from the normal midline position, can often be determined by lateral stereoscopic films. A more reliable method is by noting the position of the shadow in the anteroposterior or posteroanterior views of the skull, but it is much harder to visualize the gland in this position. It is highly important to have the head perfectly straight. Naffziger uses a stethoscope upon which there is a pointer. Sosman has used a similar method in which he employed a pelvimeter fitted with ear pieces and a long pointer. The ear pieces are placed in the patient's ears and the head rotated until the pointer is directed straight upward at the target of the tube. The head is then held in this position by means of a bandage. A mechanical device is not absolutely necessary as the head can usually be adjusted quite well by placing a finger in each of the patient's ears and rotating the head until the two fingers are equidistant from the table.

Since 1923, when observation of the position of the pineal gland was begun, there have been 23 cases verified by operation or post mortem examination in which the pineal gland has been reported as

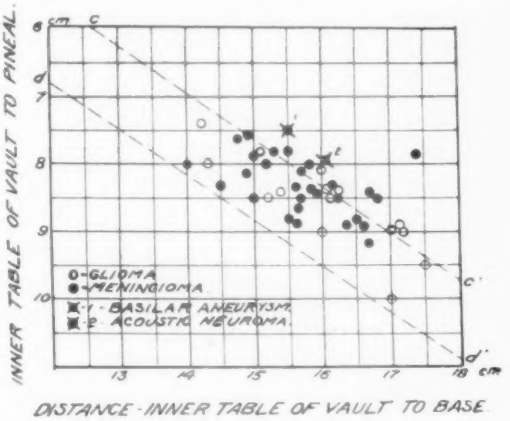


Chart 6.

showing lateral displacement. These were divided as follows:

Tumors

Frontal lobe	4	Gliomas 12
Temporal lobe	9	Meningiomas 7
Parietal lobe	6	

Intracranial Hemorrhage—2

One case of glioma of the cerebello-pontine angle and one with a large acoustic neuroma were observed in which the pineal gland was displaced to the side opposite the lesion.

Two cases in which there was intracranial hemorrhage had the pineal shadow displaced away from the side of the lesion and toward the opposite side.

It is possible that the pineal gland might be displaced *toward* the side of the lesion by cicatricial contraction following the organization of the blood clot.

SUMMARY

In this series the pineal gland was found to be displaced in 51 per cent of the patients with gliomas and in 57 per cent of the patients with meningiomas.

Acoustic neuromas were seen to cause displacement of the pineal gland in only 22 per cent of the cases.

Hydrocephalus *per se* was observed to produce a displacement of the pineal gland in only 13 per cent of the cases.

Pituitary adenomas were rarely seen to cause a change in position of the pineal gland, displacement being observed in only 10 per cent of the cases.

Intracranial hemorrhage was shown to be capable of displacing the pineal gland as observed in 2 cases.

CONCLUSIONS

This method of locating the pineal gland is not suggested as the only desirable one—there may be other and better fixed points in the skull with relation to which a normal position of the pineal gland may be determined. Further work will have to be done in this direction. It is our belief, however, that there is a normal range in position of the pineal gland and that displacement beyond these limits, when correlated with the signs and symptoms and the neurological findings will be a valuable aid in the localization of intracranial lesions.[1]

REFERENCES

1. SCHÜLLER, ARTHUR. Roentgen Diagnosis of Diseases of the Head. C. V. Mosby Company, St. Louis, 1918, p. 156.
2. NAFFZIGER, HOWARD C. A method for the localization of brain tumors—the pineal shift. *Surg., Gynec. & Obst.*, 1925, xl, 481–484.

[1] Our sincerest appreciation is expressed to Dr. Harvey Cushing for the privilege of studying and reporting this series of his cases and to Dr. M. C. Sosman, under whom this study has been made.

A METALLIC ROENTGEN TUBE (PHILIPS METALIX) AND A DETERMINATION OF THE PERMEABILITY OF ITS WALLS TO ROENTGEN RAYS*[1]

BY DR. N. A. PODKAMINSKY

Director of the Roentgen Division of the Pan-Ukrainian Institute for Industrial Medicine

CHARKOW, USSR

I

ROENTGEN tubes of today have attained a high state of perfection and power, but their fragility is not an unimportant disadvantage necessitating exceedingly cautious handling. Moreover, with the high loads (180–200 kv.) such as are now commonly employed in deep therapy, sparking may easily occur to the stand or the screen holder, thereby not infrequently ruining the tube.

The metallic roentgen tubes proposed by Bouwers and Holst in 1924 consequently represent a great improvement. They are constructed so that the incandescent filament is enclosed in a metallic chamber (Fig. 1), provided with a very small window, or "electron-diaphragm," through which the stream of ejected electrons may flow to the anode or anticathode located very close to the window. The anode and the cathode are enclosed in a metallic cylinder which is furnished with a small window of glass or chrome-iron depending on the type of tube. It is interesting to note that the evacuated tubes contain a small amount of helium or hydrogen which considerably improves their output.

The pressure of the gas in the "Metalix" tubes is 10 times greater than that in the ionic (gas) tubes and 100 to 1000 times more than that in the electronic, Coolidge type. This curious phenomenon, empirically established, still remains unexplained theoretically.

The whole tube including the glass parts

* From the Roentgen Laboratory of the Philips Works, Eindhoven, Holland (Director, Dr. Bouwers).
[1] Translated from the German by B. Cohen, PH.D. Washington, D. C.

(which are soldered to the electrodes) is enclosed in a lead cylinder coated on the outside with bakelite. The thickness of the lead sheath depends on the power of the tube, i.e., its capacity.

Tubes of Types A, B and C (Fig. 2) are provided with an anticathode having a conical depression (Fig. 4) 2.5 mm. wide and 4.8 mm. deep. This permits an almost four-fold increase in the output of the tube

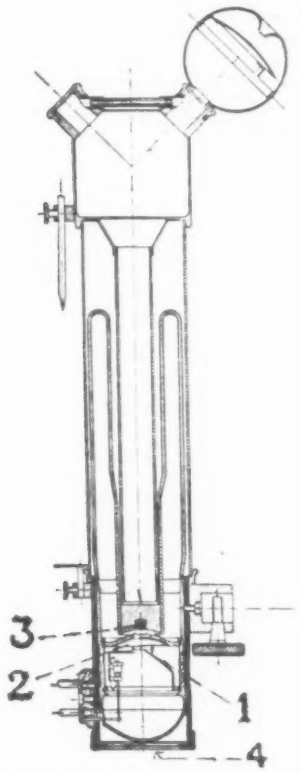


Fig. 1. Diagrammatic view of metallic roentgen tube. 1. Incandescent filament. 2. Electron diaphragm. 3. Anticathode or anode. 4. Glass window through which the roentgen rays emerge.

and at the same time preserves sharpness of focus. The roentgen rays pass through the small glass window which lies perpendicular to the axis of the tube. In the Types D, E and F (Figs. 3 and 5) there is no depression in the anticathode; the latter is fixed diagonally, as in all tubes, at an angle of 30°. In tubes of Type F, the rays travel through a window of chrome-iron up to 0.3 mm. in thickness. Some of the tubes are cooled by radiation (metal vanes) and others by means of water circulation. The metal sheath renders these tubes about eight times more durable than the ordinary glass tubes; and in addition, the employment of screened chambers becomes superfluous. The metal walls, however, permit the passage of some of the very shortest rays, and secondary rays are also produced. The magnitude of these factors is revealed in the experiments described below which were performed under the direction of Dr. Bouwers.

Fig. 2.

Fig. 3.

Fig. 2. Appearance of Philips metallic roentgen tube, Types A, B and C.
Fig. 3. Philips metallic roentgen tube, Types D and E.

It is, of course, understood that both the primary beam and the secondary rays produced while irradiating objects or patients are just as dangerous from the new tubes as from the old, and require the usual precautions.

II

The metallic tube employed in the following experiments was a Philips "metalix" Type D, which was operated at 60 kv. (effective); 3 ma. in the secondary; with a "Matema" (Amsterdam) transformer. The degree of blackening of the photographic plate (kodak, duplitized film) was determined photometrically.

Experiment 1. Lead filter, 3 mm., focus-plate distance 50 cm. The plate was placed in a plane parallel to that of the central ray. Exposure, 5 min. The result was a very slight darkening:

$$S_1 = \text{about } 0.1 \qquad (1)$$

Experiment 2. The conditions were the same as in Experiment 1 except that the exposure was for one minute, and there was no filter, so that the rays reaching the plate were secondary rays reflected from the wooden table. The result was a somewhat greater darkening of the plate:

$$S_2 = \text{about } 0.2 \qquad (2)$$

Experiment 3. No filter; focus-plate distance 200 cm. The plate was exposed directly for one second. The result was a still more pronounced darkening:

$$S_3 = \text{about } 0.25 \qquad (3)$$

Experiment 4. With no filter and a focus-skin distance of 20 cm., and other operating conditions remaining constant, an erythema dose was obtained in ten minutes.

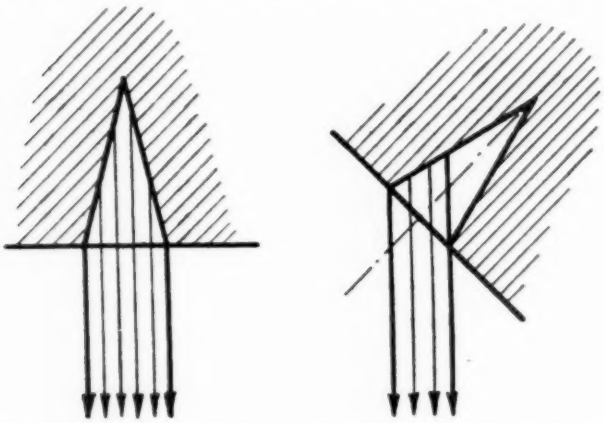


FIG. 4. Section of conical depression in anticathode in tubes of Types A, B and C, showing how sharpness of focus is maintained.

CONCLUSIONS

1. A comparison of the results of Experiments 1 and 3 gives the relation of the effect of the direct radiation to that produced by the filtered rays:

$$\frac{\text{Direct radiation}}{\text{Filtered radiation}} = \text{ca } \frac{S_3}{S_1} \times \frac{300}{1} \times \frac{200^2}{50^2} = \text{ca } 10{,}000 \qquad (4)$$

2. From Experiments 1 and 2, it follows that the intensity of the secondary rays produced by the wooden table is ten times stronger than that of the rays escaping through the metal walls of the tube:

$$\frac{\text{Secondary rays}}{\text{Filtered rays}} = \text{ca } \frac{2}{1} \cdot \frac{5}{1} = 10 \qquad (5)$$

3. From Experiments 1 and 4 it follows that at a distance of 2 meters, the rays escaping through the metal shell of the tube would be able to produce an erythema in twenty years. In other words, their effect is practically negligible:

$$10{,}000 \cdot \frac{200^2}{20^2} \cdot 10 \text{ (min.)} = 10^7 \text{ min.} = 20 \text{ yrs.} \qquad (6)$$

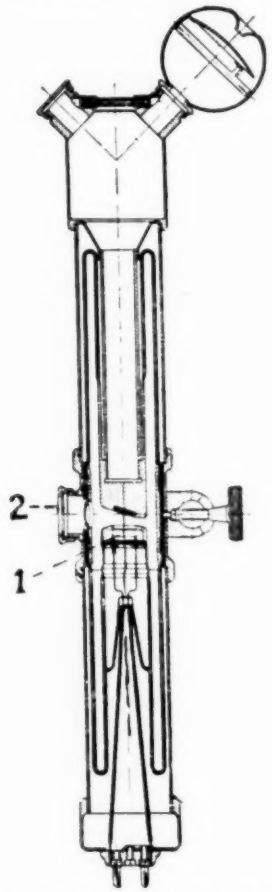


FIG. 5. Plan of the Philips metallic tube Type F. 1. Incandescent filament. 2. Window. There is no depression in the anticathode.

At a distance of 1 meter, an erythema

would be produced after five years of continual exposure. Keeping in mind the fact that the thickness of the metal shell of each tube is made proportional to its power, the above values are essentially the same for all types. The following table gives the various thicknesses:

Tube Type	Application	Thickness of Lead Wall, Mm.
A	Light diagnosis	1.5
B	General diagnosis	2.5
C	Skin therapy	2.5
D	Hard ray roentgenography and general diagnosis	3.5
E	General therapy	3.5
F	Deep therapy	6.0

III

With the metallic roentgen tube, operation is made considerably easier for the following reasons: The tube is much more durable, and it obviates the need for protective devices such as the various forms of screen boxes, safety towers ("elephants") for the Siemens "Stabilivolt" apparatus, the Wintz "cannon," etc. In therapy, especially in deep therapy, the free manipulation of the tube for purposes of one or another exact placement is of prime importance, especially in the Holfelder deep therapy technique. Moreover, there is no longer the need to center the tube in relation to the protective box or chamber. Since the anticathode or anode is located very near the wall of the tube, one obtains a very narrow beam of rays which produces only slight scattering. This renders superfluous the use of a funnel as suggested by Albers-Schönberg for absorbing secondary rays during roentgenography. The funnel is retained only for accomplishing compression wherever necessary or for irradiating a limited area. The slit diaphragm is fixed directly to the tube. Since the window in the tube may be covered over with a lead filter, the tube may be regulated (adjusted) without having to take the plates out of the room and without having to cover them with lead rubber, a circumstance which means considerable time saving in practice. The spark gap, which is fixed to the insulated wall of the tube protects the latter from the dangerous consequences of excessive voltage.

These are the considerations which prove the metallic tube to be a valuable improvement in the field of roentgenology.

REFERENCES

1. Bouwers, A. Een nieuwe Röntgenkuis. *Physica*, 1924, 173–179.
2. Bouwers, A. Eine neue Röntgenröhre aus Metall. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1924, xxxii, Kongressheft II, 41–43.
3. Bouwers, A. Ueber eine neue metallene Röntgenröhre. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1925, xxxiii, 575–576.
4. A new x-ray tube. *Lancet, Lond.*, 1924, ii, 562–563; 1925, ii, 608.
5. Bouwers, A. *Ztschr. f. Physik.*, 1923, xiv, Heft 6.
6. Bouwers, A. Measurement of the intensity of x-rays. *Acta radiol.*, 1925, iv, 368–377.

A NEW UNIFORM POTENTIAL DEEP ROENTGEN THERAPY APPARATUS

BY A. MUTSCHELLER, PH.D.

NEW YORK CITY

1. THE use of constant potential current for deep roentgen-ray therapy has been talked about so much that today for the clinical roentgenologist two questions regarding it are of particular importance. First, is the radiation produced by constant potential current different from that produced by pulsating current and second, what are the possibilities of constructing a safe and dependable constant potential current apparatus for clinical use? The latter question is the one being dealt with in this paper and its discussion is preceded by a brief review of the constant potential generating apparatus hitherto employed. Following this is described a new "hook-up" which has distinct advantages over the previously known types.

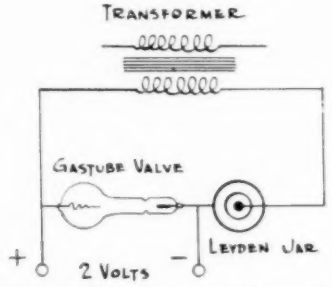


FIG. 1. Villard's earliest attempt with a valve tube and a Leyden jar condenser to produce constant potential current.

2. The first attempt to rectify and store up energy from an alternating current transformer is described by Villard.[1] He connected a gas tube valve with Leyden jars across the secondary of an induction coil (Fig. 1) and thereby obtained a unidirectional but still somewhat pulsating low voltage direct current.

3. The first report of a scheme to produce higher voltage uniform potential current is from Greinacher[2] who employed valve tubes and condensers connected in series. He connected two condensers and valve tubes across a secondary winding so that a cathode and an anode of the valves are connected to the same end of the transformer secondary. From the other electrodes of the valve tube a constant potential load can be taken off depending in magnitude upon the size of the condenser. The interesting result of this scheme is that a direct current voltage is produced which is equal to twice the transformer voltage. As Figure 2 shows, his scheme is to charge first the positive side of the symmetrical equipment and then the negative. During the intervening time the condensers give up into the load circuit

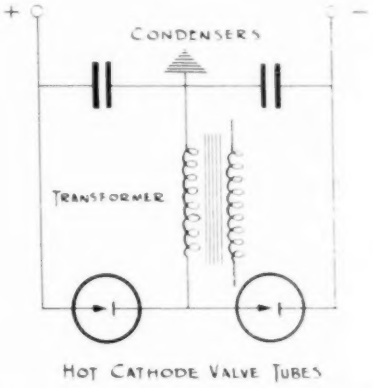


FIG. 2. Greinacher's method of producing high voltage constant potential current. The total difference of potential produced is double the transformer voltage.

a steady flow of energy through the roentgen tube during the time between impulses, resulting in a steady supply of one-half the voltage from one positively charged condenser and one-half the voltage from the other negatively charged condenser. The two electrode hot cathode tubes therefore, are provided for the purpose of preventing a back flow of power from the condensers to the transformer and they therefore, act as unidirectional valves.

4. This scheme has technically been developed in the course of time to such an extent that a quite useful therapeutic apparatus has actually been constructed, but its usefulness is limited by the fact that across each one of the valve tubes

there is developed a difference of potential equal to the total potential difference produced by the apparatus and across the condensers there is developed one-half of the total potential difference generated. Owing to the high cost and difficulty of technically constructing condensers of sufficient capacity and capable of withstanding these high voltages and owing to the impossibility of applying any higher voltages across the types of valve tubes now available, it is not possible to produce constant potential current of over 160 or at most of 180 kv. Furthermore, the apparatus thus far in use is bulky and elaborate and these limitations are a serious obstacle to the adoption of this type of apparatus for clinical use.

5. An interesting improvement was made by Hull,[3] who augmented the energy storing effect of condensers by the addition of inductances and thereby obtained a better smoothing out effect of the current voltage, but even with this improvement higher voltages are not obtainable.

6. Many additional advantages, lacking in the older systems, are obtained with the author's system particularly with respect to being able to produce higher voltages and a better voltage constancy combined with the possibility of being able to condense the bulk of the apparatus into a space not larger than that occupied by the customary rectifier type apparatus producing the same voltage.

7. Figure 4 is a schematic diagram in which C_1, C_2, C_3 and C_4 are condensers, V_1, V_2, V_3 and V_4, valve tubes and S_1, S_2 and S_3 are transformer secondaries. The secondary S_1 is grounded at one end and therefore it develops at its other end alternatingly positive and negative potential impulses. We shall assume that the potential developed by the transformer is 75

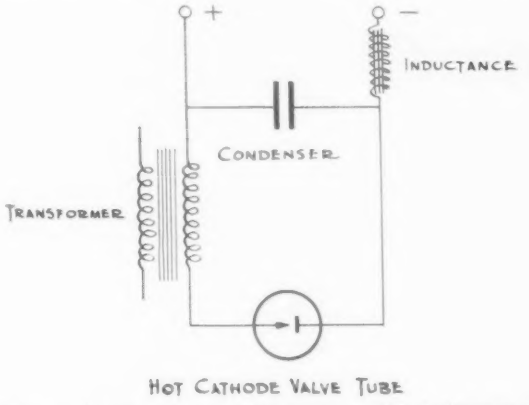


FIG. 3. Hull's scheme of improving with inductances the uniformity of the potential produced.

peak kv. Then the electrical parts within area A_1 become charged to −75 kv. positive potential and the electrical parts within area B_1 to −75 kv. negative potential. Then the secondaries S_2 and S_3, being included within areas A_1 and B_1 are separately actuated and as then they produce each an additional −75 kv., and the total voltage of 150 kv. in each branch is imparted to the electrical parts within areas A_2 and B_2, this results in a total potential difference between the terminals of areas A_2 and B_2 of 150 plus and 150 minus or of a total of 300 kv.

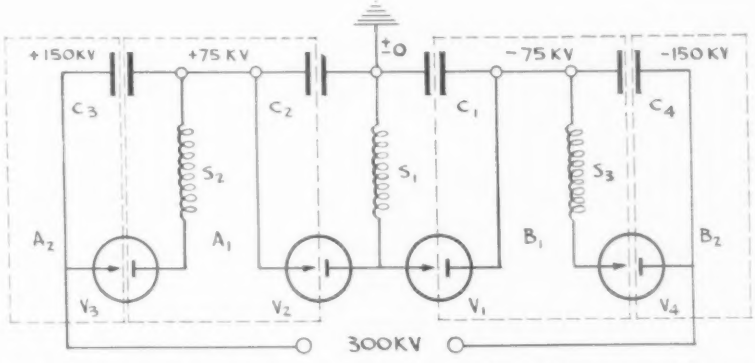


FIG. 4. The author's apparatus for developing 300 kv. uniform potential current.

8. A study of the diagram will further

show that across each of the valve tubes V_1, V_2, V_3 and V_4 there is maintained a constant potential of 75 kv. upon which is impressed an additional pulsating voltage of 75 kv. The potential strain across each valve tube, therefore, is one-half and across each of the condensers it is only one-fourth of the total voltage generated. Thus, the potential strains on any tube or condenser are only one-half those existing in Greinacher's scheme.

9. The condensers C_1 and C_2 are made of about one-half the capacity of the condensers C_3 and C_4. This is because their charging frequency is double that of condensers C_3 and C_4. These condensers receive every second impulse from secondary S_1 and in addition thereto every second impulse from the ends of secondaries S_2 and S_3 which are not connected to valve tubes V_2 and V_3. In this way, the load and electrical strain are absolutely evenly distributed among the various component parts of the apparatus.

10. The middle section of the apparatus, which is essentially Greinacher's scheme, can be replaced by an apparatus schematically represented within area C of Figure 5. This apparatus consists of two transformer secondaries S_a and S_b each in series with a valve tube V_a and V_b, and connected to posts P_a and P_b or P_c and P_b respectively. Condensers C_a and C_b are connected respectively across the posts P_a and P_d also P_a and P_c. Carried by posts P_a and P_d are switch arms which either connect across from P_a to P_d or from P_a to P_c and from P_b to P_d. If connected as shown in the diagram, then this unit is equal in performance to the previously described central unit.

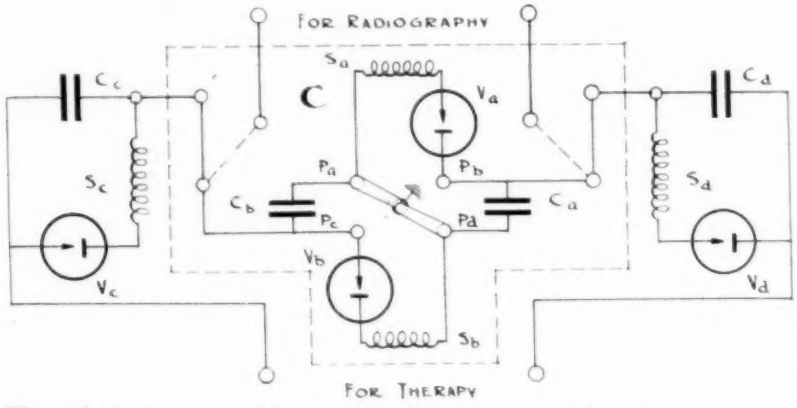


FIG. 5. The author's apparatus with a central unit that is convertible for roentgenographic work.

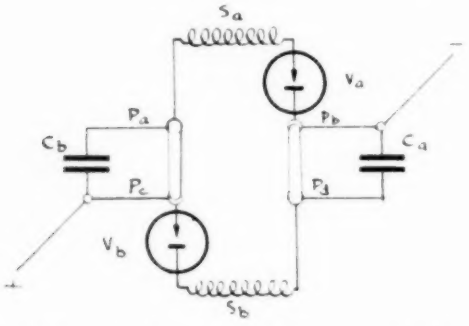


FIG. 6. The central portion of Figure 5 switched over for heavy milliamperage roentgenographic work.

11. When however, the switch arms are changed so that connection is made between P_a and P_c and between P_b and P_d instead of between P_a and P_d, and the two leads are disconnected from the two outer units and switched onto the roentgenographic tube aerial, then the condensers C_a and C_b are short circuited and are no longer in the circuit and the two secondaries and valve tubes are connected in parallel as Figure 6 shows.

12. In this case each of the secondaries and valve tubes develops and carries one-half of the total current (being connected in parallel) making possible rapid roentgenographic exposures with heavy milliamperage at the appropriate lower roentgenographic voltages.

13. But if switched over so that connection is made between P_a and P_3 as shown in Figure 5, then the secondaries and valve tubes are connected in series with the condensers across the terminals and uniform potential current is produced of double the voltage of the parallel connected system. If, for instance, a maximum of say 120 to 150 peak kv. is required for superficial and medium deep therapy, then the system when connected in series produces slightly less than double the single secondary voltage or about 150 kv. uniform potential current. This current and voltage is very satisfactory for medium deep and all surface therapy and when adjusted with the autotransformer to produce lower voltages the constant potential current is very highly efficient for roentgenographing the heaviest body parts such as the lateral spine or pelvis, etc.

14. The middle section alone of the combination thus described is, therefore, usable and very efficient as a roentgenographic and medium or surface therapy apparatus. But also, if connected onto the two outside units, it functions highly efficiently for producing uniform potential current of over 200 kv. with the same even distribution of potential and current strains as the unit above described.

15. Ordinarily with power current of as low as 50 cycles a fully uniform voltage is obtained with the capacities employed. For still lower frequencies there is the possibility of exciting the three secondaries S_1 (or S_a and S_b) and S_2 and S_3 asynchronously with three phase current and the resulting equivalents would, in the case of 25 cycle three phase current, be equal to 75 cycle of synchronously applied, single phase primary current.

16. Being subdivided into a larger number of parts than in the Greinacher scheme alone, the component parts such as transformers, condensers, etc., are all comparatively small in size. This lends itself readily to grouping together of the various component parts into comparatively small units to be immersed in oil. Thus, the units can be grouped as shown in Figure 4 and all parts except the valve tubes are immersed in tanks in oil whereby obviously many valuable additional advantages are secured.

17. Among the most prominent advantages of the system here described are: (1) absence of all noise, corona losses, and the production of nitric fumes; (2) no collecting of dust or moisture upon any of the insulating parts; (3) comparative ease with which the valve tubes can be cleaned and full visibility if valve tubes filaments should not operate correctly; (4) absence of insulation difficulties in rarefied atmospheres such as at high altitudes because all high potential electrical parts are immersed under oil; (5) no possibility of overheating due to the effective cooling by the large volume of oil; (6) danger of accidents from shocks are minimized and possibilities of tampering with parts of the apparatus by cleaners are impossible because of the complete enclosure of the apparatus in the oil tanks, and (7) possibility of switching the high voltage uniform potential deep therapy apparatus over for use as a high power noiseless roentgenographic apparatus enabling the utilization of a lower voltage heavy milliamperage of pulsating current for short time exposures or of uniform potential current for penetrating successfully for roentgenographic work the heaviest body parts as well as for superficial and for medium deep therapy.

REFERENCES

1. Villard, P. Transformateur a haut voltage a survolteur cathodique. *J. de physique*, 1901, x, 3. s., 28–32.

2. Greinacher, H. Über einen Gleichrichter zur Erzeugung konstanter Gleichspannung. *Verhandl. f. d. deutsch. phys. Gesellsch.*, 1914, xvi, 320–326.

3. Hull, Albert W. The maximum frequency of x-rays at constant voltages between 30,000 and 100,000. *Physical Rev.*, 1916, vii (series 2), 156–158.

AN INOPERABLE OVARIAN TUMOR TREATED BY THE METHOD OF E. G. MAYER*

ROENTGEN THERAPY ALONE INEFFECTIVE; COMBINED WITH GLUCOSE INJECTIONS YIELDED DESIRED EFFECT; RADICAL OPERATION

BY PROF. G. HOLZKNECHT

VIENNA

WITHOUT anticipating the detailed presentation of the cases in which E. G. Mayer has sought, on the basis of Warburg's findings, to augment the roentgen effect upon tumors by a combination of roentgen therapy with intravenous injections of osmon,[1] I should like to describe the following interesting case. Of course not all cases are influenced to the same favorable degree, as has already been pointed out by Mayer in his preliminary reports. Nevertheless, the percentage showing astonishing response is so great that the new procedure deserves attention.

CASE REPORT

The patient was twenty years old, the wife of a rural official. An ovarian cyst on the left side was found and removed in July, 1923, by Dr. Papinianu, the well-known Rumanian surgeon. The pathological report made by Teodorescu was papillomatous cystadenocarcinoma.

In the summer of 1924, the gynecologist, Prof. Gerota, found a tumor on the right side palpable through the uterus. He prescribed roentgen irradiation which was administered in two customary series. The size of the abdomen continued to increase and ascites appeared. In November, 1925 upon urging of her relatives, the patient underwert a relaparotomy, and 4 liters of blood-tinged ascitic fluid was removed. The remaining ovary was palpated and found to be adherent to the intestines; the uterus, pelvic peritoneum and also certain areas on the intestines were studded with tumors. The abdominal incision was closed. The patient had no stool for eighteen days. Weight continued to decrease; and menstruation ceased. The patient's relatives again set their hopes upon roentgen treatment.

I was consulted with this purpose in view; and because of the pathological findings and the inefficacy of the previous irradiation by the usual method, I decided that it was not indicated. However, we had at that time already obtained some promising results with the combination of irradiation with dextrose injections and had already reached the point of reducing the roentgen doses in the application of the combined treatment. A trial treatment of this type which could be recommended consisted first of a series of four irradiations over four large fields on the whole pelvis, each field receiving one-half of a skin erythema dose (= H through 0.6 mm. Cu with therapy rays of medium hardness). Two days preceding and immediately before each irradiation there was injected intravenously (by Dr. Nemetz) 10 c.c. of osmon solution containing 33 per cent of protein-free dextrose, and when the small veins became unavailable the glucose was introduced intracavernally into the corpus spongiosum of the lower turbinal.

The gynecological findings made on the day of the first irradiation toward the end of January, 1926 (Dr. R. Graf) were as follows: "Vaginally: a small uterine stump is present (apparently the uterus was amputated supravaginally at the second operation); behind the uterus and filling a large part of the small pelvis there is present a fairly dense, very slightly movable tumor larger than a fist in size, and painful to pressure; this tumor extends to the *left* up to the lateral pelvic wall. The left adnexa seem to have disappeared within the tumor. Rectally: the tumor in the small pelvis is palpated even more distinctly, and there is also a sausage shaped tumor (left adnexa) about two fingers' width thick reaching to the left pelvic wall. Under rectal examination the lateral tumor is especially painful. The right adnexa cannot be palpated. An exact determination of the upper limit of the main tumor is not possible, but it does not appear to extend beyond the small pelvis. In the rectum itself no changes can be palpated and the mucosa is easily movable throughout."

Five days after the last irradiation (ten days after the first) the report made by Dr. Graf was

[1] Protein-free dextrose prepared by Pharmazeutische Industrie A.G., Vienna.

* Translated by B. Cohen, PH.D., Washington, D. C.

as follows: "The findings in the case have changed somewhat since the last report. The tumor has certainly become rather smaller, more definitely outlined, softer, and above all more movable. Whereas at the first examination, I obtained the impression of a firmly anchored tumor upon which an operation was entirely out of the question, my impression now is that of an operable tumor."

On the eighth day after the last irradiation a spontaneous stool occurred for the first time, which function has continued since; appetite has returned and pelvic pains have disappeared.

Ten days after the last irradiation Dr. Graf made the following report: "A further distinct retrogression of the tumor is to be reported. In addition, the tumor is *very* soft and less sensitive. The main portion of the tumor now lies posteriorly toward the sacrum. As compared with the findings at the first examination, the tumor has receded to about one-third of the original size."

Eight days later the patient consulted the gynecologist, Dr. A. Blau, whom I requested to consider especially in his examination the question of operability. His report is as follows: "I must state that after studying the anamnesis I approached the gynecological examination with the conviction that I would not be able to recommend an operative removal. To my surprise, the gynecological and abdominal conditions are such that I cannot refrain from recommending that an attempt at operation be made. Within the Douglas pouch and almost filling the true pelvis, there lies a somewhat elongated tumor about the size of a fist, mainly cystic (multilocular) and with a *smooth* surface, which is fixed by its size but appears, however, not strongly adherent (as evidenced, for instance by the fact that the uterus is very easily moveable toward the tumor). There appears to be *no* ascites associated with it; and it has no demonstrable metastases on the peritoneum. Does this indicate that the peritoneal metastases have perhaps been made to disappear by the roentgenization? If so, there is all the more indication for *attempting* the operative removal of the cystic carcinomatous focus. I consider an attempt at operation as indicated."

As between the advisability of operating at this stage or awaiting the effect of a further roentgen treatment, it was decided to follow the latter course. During the middle of February, 1926, the patient received the same cross fire irradiation of half an erythema dose through each of four fields, together with an osmon injection immediately before each irradiation.

The examination made by Dr. Graf at the beginning of the series was reported as follows: "No important difference is noted as compared with the last examination (February 6). The tumor appears to have become somewhat softer."

The patient returned to her own country and was observed by Prof. Papinianu whose report of May, 1926, is as follows:

"Mrs. S. C., has again reported to me, and I have examined her every two weeks. In the early examinations I found locally a sharply outlined, crescent shaped tumor, located behind the uterus, with its middle portion filling the Douglas pouch and each end reaching behind the base of the broad ligament. In the middle of the tumor, behind the neck of the uterus, there was a small tumor the size of a plum projecting toward the rectum. In subsequent examinations the tumor appears to have remained stationary. The general condition has remained good all the time. At the last examination the tumor appeared to be yielding and I suggested operation. It was my belief that it would be possible to resect only very little as at the second operation, and I was of the opinion that there existed *infiltrations in the pelvic tissue* and in the base of the broad ligament. I was agreeably surprised to find that the tumor, or rather tumors, were entirely isolated, and that I could perform a hysterectomy. Although the tumors were adherent to the rectum and colon, they could be separated with a little care, and they were quite readily and completely removed. Several small tumors on the mesocolon and the peritoneum of the iliac fossa were also removed. No macroscopically visible tumor was allowed to remain. The rest of the abdomen was examined, but I found no other tumors."

After the radical operation the patient returned to Vienna and the following gynecological report (Dr. Graf) was made: "Apart from a dense band on the left side, nothing pathological can be palpated either vaginally or rectally."

The tissue was examined by Prof. C. Sternberg who reported as follows: "From patient, Mrs. C., there were submitted for examination several specimens preserved in formalin, namely, (1) one-half of a medially split uterus with hard fibrous wall; (2) a tumor, somewhat larger than a nut, which on section was found to be a thin-walled cyst filled with gelatinous contents; (3) a mass, about the size of a hazel nut and inclosed in fat, which was found to be a cyst with a smooth, brown interior surface; (4) a villous piece of tissue containing at one end a dense nodule about the size of a cherry.

"The histological examination of the uterus shows the mucosa to be strikingly thin. The stroma is rather densely fibrous, and the glands are small but uniformly constituted. The picture is that of an atrophy of the mucosa and there is no sign suggestive of malignant growth. All the other tissue specimens show essentially the same finding. They appear to be portions of a cystic tumor which originated in the ovary, as was evident in the peripheral zone of specimen #4. The tumor consists of cysts of different sizes, all of which seem to be furnished throughout with a very uniform epithelium consisting of one or two rows of either cuboidal or distinctly cylindrical cells. In many of the cysts there are present papillary protrusions of the wall, which are usually low, but often appear higher with branches and sub-branches, all covered with the uniform epithelium of the cyst. The cysts are surrounded by a dense fibrous stroma which is very sharply limited against the epithelium. Only at a few points does one see some small glandular areas within the stroma adjoining the larger cysts. Noteworthy is the unusually extensive, almost massive development of calcified structures (corpora arenaria) both in the epithelial portions and in the connective tissue stroma. Nowhere are there any signs evident of atypical cell development or of infiltrating growth. The interior of the cystic spaces contains entirely homogeneous material. From the above findings, one must make the diagnosis of glandular cystoma with formation of papillary excresences. There was not found a single sign in the tissues examined to suggest malignant tumor or carcinoma."

We see in this case an effect of roentgen treatment which is remarkable both as regards its extent and its rapidity of action. Hitherto, only in favorable sarcomas have we found such rapid regression of a tumor after irradiation. Gold[1] reported a case of sarcoma in a cryptorchic testis which regressed with similar rapidity and from which, after irradiation, Eiselsberg extirpated the residual involuted tissue. We have observed this rapidity of response among other tumors only since the employment of dextrose injections. The question as to whether our case was a primary papillomatous cystadenoma which underwent secondary malignant degeneration cannot be decided. Further observations will be necessary to clear up this point. This, however, does not affect the clinical significance of the effect observed.

[1] Gold, E. Malignant sarcoma of the testicle made operable by roentgen ray. *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1924, xxxviii, 102–113.

Vol. XVII, No. 3

RADIOTHERAPY OF CANCER OF THE CERVIX AT THE RADIUM INSTITUTE, PARIS, FRANCE

BY MAURICE LENZ, M.D.

Attending Radiotherapist, Montefiore Hospital; Associate Radiotherapist, Mount Sinai Hospital

NEW YORK CITY

CLINICAL experience with radiation therapy in cases of cancer of the cervix has shown that by the use of this method in inoperable cases it is frequently possible to obtain palliative results and occasionally permanent regression of the disease. In early operable cases the results of radiotherapy have in a number of clinics been comparable to those obtained by surgery.[1] Some clinicians[2] have adopted this therapy in preference to operative treatment, especially as the primary mortality with its use is negligible in comparison with that following surgery. While it is generally conceded that radiotherapy is of value in the treatment of cancer of the cervix, the method of its application still remains a moot question. In this paper it is the intention of the writer to present the view held on this subject at the Radium Institute at Paris, France.

When a case of suspected carcinoma of the cervix is seen at the Radium Institute for the first time, a thorough clinical examination is made. The extent of the involvement, patency and size of the uterine canal are determined. A bacteriological examination of the vaginal flora is made. A biopsy is performed and a plan of treatment is outlined.

Histology. If the histological report is epidermoid carcinoma the case is treated only with radiotherapy. Surgery is not resorted to even in early operable cases, except if the growth proves to be an adenocarcinoma. In the latter a radical hysterectomy is done three or four weeks after a thorough course of radiotherapy has been given. Nearly all recurrences of early cervical cancers, irradiated at the Radium Institute, were adenocarcinomata. Hence, these growths are regarded as radioresistant, an observation which has also been made by Lahm,[3] Adler[4] and others. Among the epidermoid carcinomata, those with a predominance of prickle cells and a tendency towards glandular differentiation are considered to be less radiosensitive than those with complete stratification and development of hornified cells. However, this variation in structure does not influence the plan of treatment in epidermoid carcinomata.

If the growth is of the papillary cauliflower variety spreading along the surface without apparent invasion of the deeper structures, the tumor is regarded as more favorable for radiotherapy than when an infiltrative ingrowing tendency is noted. Infiltrations of the anterior or posterior vaginal septa are looked upon as especially grave; rectovaginal and vesicovaginal fistulae usually follow energetic radiotherapy of this complication.

Infection of the deeper structures is considered a contraindication to radiotherapy. This occurs especially frequently in the infiltrative variety of cancer. For instance, radiation is not given in the presence of parametritis or pelvic cellulitis. Neglect of this precaution has at times been followed by a localized chronic peritonitis which slowly saps the strength of the patient, or by the rapid spreading of the infection and death from bacteriemia. Obese, anemic women suffering from chronic, debilitating diseases, such as diabetes, nephritis, etc., appear to have been especially subject to this complication. The only exception to this rule is made in cases of early papillary cauliflower growths, as the infection here is usually localized to the surface of the neoplasm, and the shedding of the radiation slough carries away with it the entire area of infection. Latent infection in the periuterine tissues is regarded as dangerous. Exacerbation of the infection has followed internal or external irradiation by roentgen rays or radium, or the preliminary intrauterine instrumentation alone. A sterile pyometra has thus become secondarily infected after dilatation, and latent salpingitis lighted up by irradiation. Bumm[5]

and others[6] have reported similar experiences. To clear up infection, daily vaginal and occasionally intrauterine irrigation of sterile water, or normal salt solution are employed; also swabbing with glycerine or 10 per cent glucose solution, as suggested by Nogier. For staphylococcus infection surgical cleanliness and vaccines are employed. For spirillum infections, bismuth paste locally and salvarsan intravenously are given.

After the extent, the clinical and histological variety of the growth have been determined and after the infection has been taken care of, a plan of radiotherapeutic procedure is outlined.

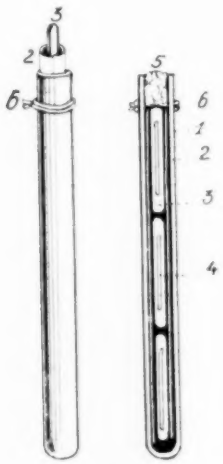


Fig. 1. Uterine applicator. 1. Rubber catheter. 2. Aluminum foil. 3. Platinum filter. 4. Radium or radon tube. 5. Cotton plug. 6. Ligature tying catheter.

The anatomical localization of cervical cancer is such that usually two avenues of approach for attacking the disease by irradiation are feasible. The radiation may be applied from without, that is, through the skin, or from within, that is, through the vagina and uterine canal. Where the disease is localized to the cervix, the latter approach is usually easier than the former. Where invasion has taken place into the outer parts of the parametria or pelvic glands this portion of the disease is closer to the body surface and therefore more easily influenced by irradiation from without. When external irradiation is employed it is necessary to traverse a great bulk of normal tissue before reaching the cervix. The greater portion of the radiation intensity applied on the surface is absorbed in the intervening structures and may affect such radiosensitive organs as the rectum and bladder. When radium is placed in the uterine canal the walls of the uterus act as a screen and increase the distance between the source of radiation and the rectum and bladder. This distance may also be increased by gauze packing in the vagina. After hysterectomy the narrow finger-shaped fornix offers little room for gauze packing. The source of radiation is therefore brought into closer contact with the bladder, rectum, and loops of intestines. Smaller radiation intensities must consequently be given in these cases, which partly accounts for the poor radiotherapeutic results after hysterectomy. In these cases as well as in cases in which anatomical deformities, such as atresia or obstruction of the vagina or of the cervical canal preclude the proper placing of the internal radiating focus, external radiation therapy is principally relied upon.

Only local radiotherapy is relied upon in the treatment of cancer at the Radium Institute. They do not employ roentgen rays in fractional erythema intensities to the thymus, spleen and lymph nodes as suggested by Fränkel,[7] with the hope of increasing the resistance of the body to cancer. In the majority of cancer patients these organs are undergoing a normal process of age involution at the time when they are first seen. If irradiated with small doses of roentgen rays, this age atrophy is probably accelerated as may be assumed from some experimental work of the writer[8] on the action of small doses of roentgen rays on the thymus of the rabbit.

No attempts have been made recently to increase the body resistance to cancer by injections of foreign proteins[9] or of various anticancer vaccines[10] at the Radium Institute. Neither diathermia[11] nor the galvanic current[12] has been used to increase the radiosensitiveness of the cancer cells, nor have secondary radiators, e. g., such as those used by Wintz,[13] been employed to increase the local effectiveness of the rays. Irradiation of metastases in pelvic glands and parametria has not been attempted by inserting radium through bilateral incisions

in the ischiorectal fossae,[3] or by passing a chain of radium capsules extraperitoneally along the pelvic wall through inguinal and perineal incisions.[14] The experience with interstitial implantation of filtered or unfiltered radium into palpable metastases in the parametria through a laparatomy wound[19] has yielded such poor results that this method of approach has been given up at the Radium Institute.

If the cancer is localized to the cervix, with or without slight invasion of the inner portions of the parametria, the uterine and vaginal canals are used as the only localizations for the irradiating substance. External radiotherapy is added only if the disease extends to the outer portions of the parametria or pelvic glands, or if anatomical deformities preclude proper irradiation from within. When radium and roentgen rays are combined, the roentgen treatment precedes the curie therapy. Of 10 cases in which this was done, 3 cases were free from clinical evidence of disease two and three years later, while none of 10 cases in whom roentgen therapy had followed treatment with radium, were alive at the end of a like period. Experience with other epidermoid carcinomata, for instance, those of the skin, has also shown that these growths will react to radium after unsuccessful roentgen therapy, while they will not respond to roentgen therapy after radium treatment has proved inefficient.

The principles of roentgen therapy consist in giving small doses of highly filtered roentgen rays for one hour, twice daily, for a period of ten to twenty-five days; i.e., twenty-five to fifty-five hours of actual irradiation are administered during this period. The treatment is interrupted if any symptoms of intestinal irritation, such as diarrhea or cramps occur. The patients usually gain strength, appetite, and weight during the course of the treatment. The radiant energy is administered in the following manner: A 200 kv. transformer machine, 4 ma., 2 mm. zinc, 3 mm. Al and 3 cm. wood filter, 50 cm. focal distance, and usually six or more over-lapping 15 × 15

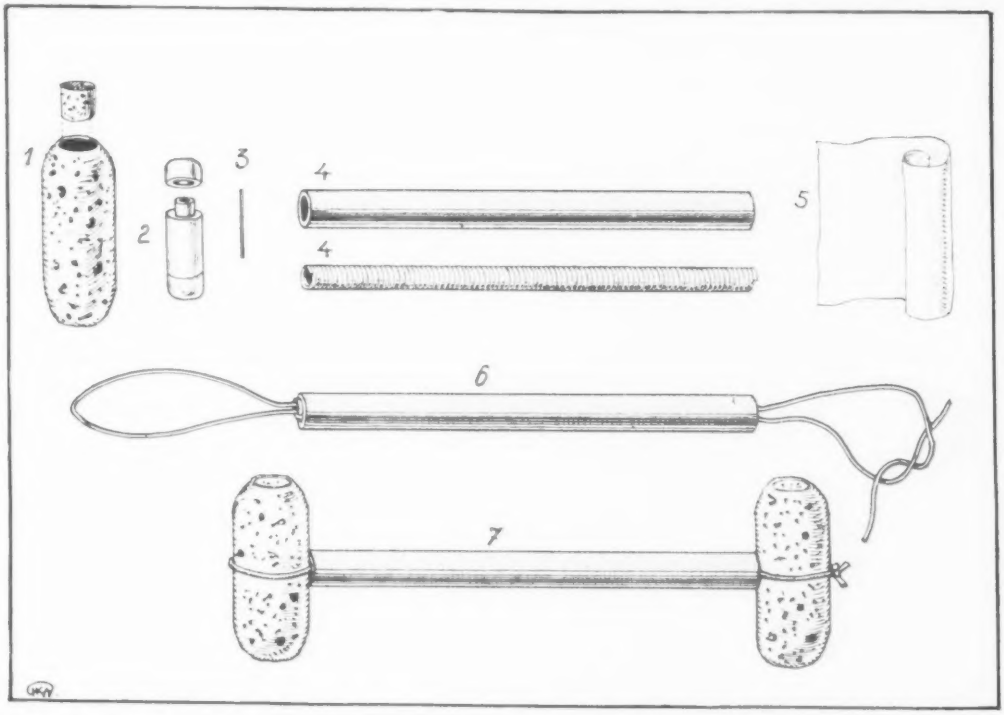


FIG. 2. Vaginal applicators. 1. Cork with plug removed at one end. 2. Platinum capsule for radium. 3. Glass tube containing radon or radium. 4. Steel spring and rubber tube covering. 5. Aluminum foil for secondary filter. 6. The spring of the colpostat ready for attachment of corks. 7. The colpostat ready for use.

cm. fields are used. The fields are abdominal, gluteal, lateral and perineal; each field receives on the average of 2 or 3 H per hour, 12 H producing an erythema and 35 H a second degree dermatitis under these conditions. A total of 100 to 120 H, i.e., 28,000 Solomon R units, or 13,000 Behnken R units are thus given to all fields if internal irradiation is not to be used, or 70 to

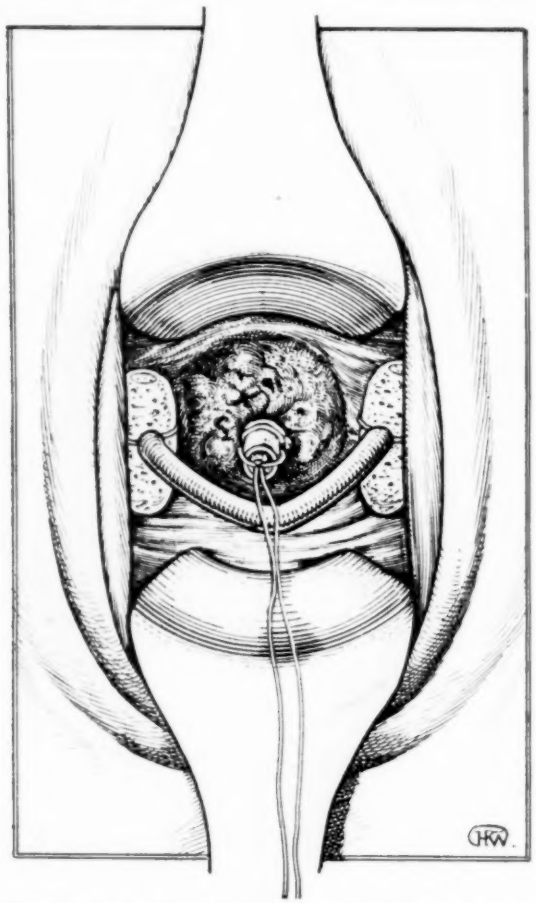


Fig. 3. Cervix viewed from the vagina. End of uterine applicator slightly protruding from the cervix. Corks of the colpostat in each lateral fornix.

80 H if radium in the uterus and vagina is to be employed.

For curie therapy the patient is prepared as for an operation—bowels cleaned out, vulva shaved, vagina cleansed, uterine and vaginal applicators prepared and sterilized. Gradual dilatation with Hegar dilators up to size 10 French is performed, and the uterine applicator is inserted as the last dilator is withdrawn. If a pyometra is discovered at this time or if any infection of the uterus or adnexa is found, irradiation is not started until the infection has cleared up. Should an obstructing cauliflower mass, or ulcerating growth at the external os make the localization of the cervical canal impossible, vaginal irradiation is used first; in eight or ten days, the obstructing growth sloughs off, and the cervical canal can then usually be found; if this cannot be done external irradiation is relied upon.

When the uterine applicator is in place, a small tampon of ichthyol glycerine is placed against the cervix and this is followed by insertion of the vaginal applicators into each lateral fornix. Lastly gauze packing is inserted so as to push the rectum and bladder as far as possible from the radium. The irradiation is continued for five to seven days until the desired dose has been given. The treatment is never repeated unless recurrence takes place. Once a day the applicators are removed, cleansed and the uterine applicator is boiled. A vaginal douche of hot water is given and the applicators reinserted at once.

If fever or chills occur during the irradiation the uterine applicator is removed so as to allow free uterine drainage, while the vaginal irradiation may, or may not, be continued. If the temperature does not become normal within twenty-four hours all irradiation is discontinued until all signs of infection have disappeared.

The uterine applicator consists of a 2 mm. thick, 6 cm. long, para rubber catheter free from metal. It is blind at its uterine and open at its vaginal end. Its bore is 3 mm., i.e., broad enough to admit the usual radium bearing capsules, which are inserted into it, one behind the other; the vaginal end is securely tied by a silk ligature. There are usually employed three, but at times one or four radium bearing capsules, depending upon the size of the uterine canal as determined at the first clinical examination. The rubber catheter is correspondingly shorter or longer but usually measures 6 to 7 cm. Each radium bearing capsule is 20 to 22 mm. long, has a radiating surface of 0.6 × 15 mm. and has a wall thickness of 1 mm. of platinum. Each capsule is individually wrapped in alumi-

num foil 0.2 mm. thick to arrest the secondary radiation from the platinum. The upper capsule, nearest the fundus, usually contains 6.66 mg. of radium element; each of the lower tubes contains 13.33 mg. radium element. Rarely when radon is used, the initial quantity is 15 to 20 millicuries per tube; 13.33 mg. element delivers 100 "millicuries destroyed" per hour and 6.66 mg. gives off half of this amount. The uterine applicator usually contains a total of 33.32 mg. of radium element and therefore delivers 30 "millicuries destroyed" in five days, i.e., in round numbers 4000 milligram-hours. The catheter is semiflexible and adjusts itself to the contour of the uterine canal. It usually has a radiating surface of 6 to 7 cm., a focal distance of over 3 mm. and the rays are filtered through 1 mm. of platinum.

The vaginal applicators consist of similar radium bearing capsules, containing 13.33 or 6.66 mg. radium element. However, they are of 2 mm. platinum wall strength and each capsule is inserted through the center of an ordinary cork 1.5 cm. broad and 2.5 cm. long. This leaves more than 0.5 cm. wall of cork on either side, for focal distance. After the radium capsule with its aluminum wrapping has been inserted into the cork, the open ends are closed by little cork plugs and the cork tied along its long axis by a silk ligature. It is then immersed in boiling paraffin at 120° C. for twenty minutes. This sterilizes the applicator and covers it with an impermeable layer. Two of these corks are usually mounted on a 1 × 10 cm. steel strip covered by rubber tubing and the applicator is then known as a colpostat. The corks of the colpostat are inserted one into each lateral fornix with ends directed towards bladder and rectum and the steel strip bent into a U with the open end towards the cervix. The spring action of the steel strip forces the corks against the vaginal wall and maintains them vertically in the vagina in close proximity to the parametria, while the bladder and the rectum receive the radiation only from the ends of the capsules. As the metal strip passes in front of the os, it also prevents the radium bearing catheter from slipping out of the uterine canal, especially if a small piece of gauze is placed against the cervix. An additional third or even fourth cork in front and behind the cervix may now be inserted if room permits and circumstances demand it. If the disease appears to be unilateral, the stronger radium capsule is placed closer to the diseased area, while the weaker is inserted into the opposite fornix. About 26.66 mg. of radium element

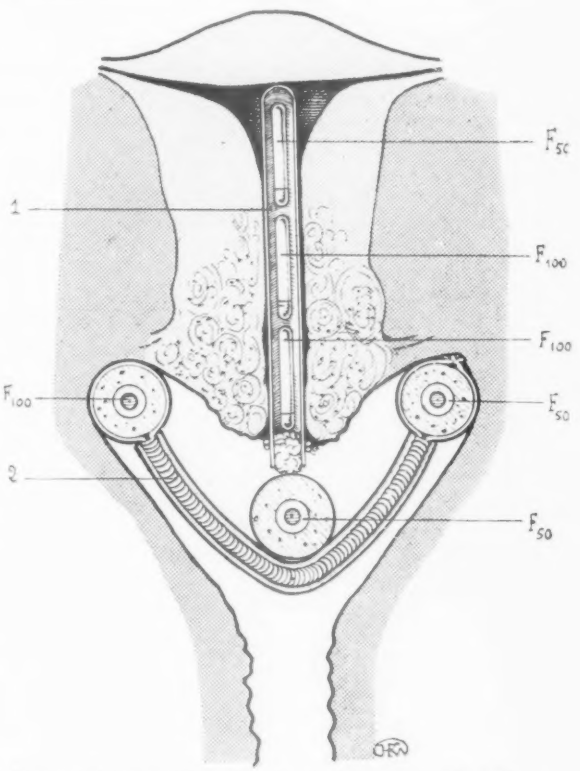


FIG. 4. Cross section of uterus and vagina with radium applicators in position. 1. Uterine applicator consisting of three tubes, the upper focus (F) delivering 50 microcuries, the lower two each 100 "microcuries destroyed" per hour. 2. Cross section of three vaginal "corks" with vaginal radiating foci (F), one delivering 100, the other two each 50 "microcuries destroyed" per hour. Two of the corks are mounted on the colpostat while one is lying free.

is usually employed in the vaginal applicators. If left in place for five days this will deliver 24 "millicuries destroyed", i.e., 3168 mg-hr. In other words, ~200 mg-hr. may thus be given with the uterine and vaginal applicators, while using only about 60 mg. of radium element.

If this method is compared with those in use at other clinics its advantages become apparent. The long radiating surface of the

uterine applicator not only irradiates the entire cavity of the uterus, but delivers a greater depth dose than do the shorter applicators of the same strength used in other clinics.[3] The use of the platinum filtration reduces the bulk of the applicator and permits the employment of large radiation doses. Whether the use of such heavy filtration, or its lead equivalent as employed by Heyman is essential may be questioned. Bumm,[5] Döderlein,[15] Kehrer,[3] and Healy[16] who use lighter filters also show good results. The vaginal radium bearing corks are pressed into the fornices by the spring action of the colpostat and the radiating foci are thus brought closer to the parametria than when pessaries are used for holding the radium in position.[3] On the other hand, it would seem that exact localization of an applicator against small infiltrations in the vaginal mucosa or cervical crater, can be attained more accurately by such flat and conical applicators as used by Heyman,[2] while involvement of the vault of the fornix after hysterectomy, may possibly be more easily treated by a bomb as used at the Memorial Hospital.[16] However, it takes 1000 mc. to fill the Memorial "bomb" in contrast to less than 30 mg. of radium needed for vaginal corks as used at the Radium Institute. The continuous slow irradiation may also be of advantage as it probably strikes more cancer cells during the state of mitosis, that is, during a period of their greatest radiosensitivity, than does the same amount of radiation given over a shorter time. The likelihood of infection when a uterine applicator is left in for six days is not as great as might be assumed. There were only 6 among 362 treated and traced patients, with carcinoma of the cervix at the Radium Institute, who died from infection following the treatment. The total dose of 7000–8000 mc-hr. seems to be correct, as lesser amounts or very much larger doses do not yield as good statistics. The results of Clark,[1] who used 4800 mc-hr., divided into two sessions, six weeks apart, are not as good as those of Bumm, Kehrer, Döderlein, Heyman and Healy, all of whom use on the average from 6000–7000 mc-hr. On the other hand, Lahm[3] reports bad results from doses larger than 10,000 mc-hr.; Bumm[5] noted perforations into the rectum and bladder when larger doses were used. The omission of external roentgen therapy in early operable cases does not seem important, if sufficient radium is used in the vagina and cervix. This is illustrated by the results of Healy who in addition to an excellent radium technique uses roentgen therapy in every case including early operable cases. His results are no better than those of Heyman and Kehrer who limit the use of roentgen therapy to far advanced cases.

The technique described has been in use at the Radium Institute since 1920. In the first and second years, the work was done at various hospitals and lacked system. The results therefore are not as satisfactory as those of the last three or four years, since which time the technique has been standardized and all patients treated under the direct supervision of Prof. Regaud at the Pasteur Institute, Chantin Hospital and Radium Institute.

The improvement in the results becomes evident when one compares the number of cases judged as free from clinical evidence of disease at the end of the first year. These steadily improved with each year: thus in 1919, 14.9 per cent of the cases, i.e., 13 patients, were judged clinically free from evidence of disease; in 1920, 23.8 per cent i.e., 21 cases; in 1921, 40.9 per cent; in 1922, 37.7 per cent; in 1923, 43.9 per cent were classified as free from clinical evidence of disease at the end of one year. That this classification was fairly correct may be seen from the fact that of the 13 cases treated in 1919 eight remained well four to five years later, and of 21 cases of the 1920 series 17 remained well three to four years later.

There were 403 cases of cancer of the cervix treated at the Radium Institute in the years 1919 to 1923. Of these 10 per cent were early operable; 33.5 per cent doubtful and 56.5 per cent inoperable. Of the 403 cases, 41 cases cannot be utilized for statistics as they had been lost sight of while improving, or histological examination had failed to support the clinical diagnosis of cancer, or death had occurred due to intercurrent disease, while the cancer had healed. There were left 362 histologically

proven cases which could be traced. Of these, 211 were inoperable and 151 early operable or of borderline operability. Of the 362 patients traced up to September, 1925, 236 died of cancer; 6 died of infection following the treatment in 1919 and 1920; 28 were living but presented evidence of the disease; 3 had hysterectomies done and the uterus in each showed the presence of cancer on section; 95 patients, i.e., 26.2 per cent of the total were alive and free from clinical evidence of disease; 59 of these were early operable or of doubtful operability, while 36 were inoperable. Of the 95 cases there were treated:

9.1 per cent or 5 operable or borderline cases and 3 inoperable cases in 1919.

19.3 per cent or 10 operable or borderline cases and 7 inoperable cases in 1920.

29.5 per cent or 9 operable or borderline cases and 4 inoperable cases in 1921.

34.4 per cent or 13 operable or borderline cases and 8 inoperable cases in 1922.

43.9 per cent or 22 operable or borderline cases and 14 inoperable cases in 1923.

These results compare favorably with the results of most other clinics and justify the employment of the technique described.

CONCLUSIONS

1. The technique of the treatment of carcinoma of the cervix by radium and roentgen rays should be influenced by anatomical, histological and bacteriolocal considerations and the clinical aspect of the case.

2. The technique employed at the Radium Institute of Paris represents an efficient method for this treatment with a small initial quantity of radium.

In conclusion, I wish to thank Prof. Regaud and his associates Drs. Lacassagne, Monod and Coutard for helping me to familiarize myself with the technique described and for permitting me to use their material in publication of this paper, and Miss Turnessen for help in collection of the records.

REFERENCES

1. Clark, J. G., and Block, F. B. Relative values of irradiation and radical hysterectomy for cancer of the cervix. *Am. J. Obst. & Gynec.*, 1924, vii, 543–549.
Clark, J. G., and Keene, F. E. Irradiation in cancer of female genito-urinary organs; results in 313 cases. *J. Am. M. Ass.*, 1921, lxxvii, 613.

2. Heyman, J. Technique and results in treatment of uterine cervix at "Radiumhemmet," Stockholm. *J. Obst. & Gynaec. Brit. Emp.*, 1924, xxxi, 1–19.
Heyman, J., and others. Treatment of inoperable cancer of female pelvic organs. *Brit. M. J.*, 1925, ii, 827–841.

3. Lahm, W. Die Strahlenbehandlung des Kollumkarzinoms. *Ergebn. d. med. Strahlenforsch.* Leipzig, 1925, i, 527–664.
Kehrer, E. Die Radiumbestrahlung der bösartiger Neubildungen. *Verhandl. deutsch. Gesellsch. f. Gynaek.*, 1920, xvi, 3.

4. Adler, Ludwig. Die Radiumbehandlung maligner Tumoren in der Gynäkologie. Urban and Schwarzenberg, Wien, 1919.

5. Bumm, E. Quoted by Lahm, W., *Ergebn. d. med. Strahlensforsch.*, 1925, i, 589.
Bumm, E., and Schäfer, P. Erfahrungen über die Strahlenbehandlung der Genitalkarzinome. *Arch. f. Gynaek.*, 1916–17, cvi, 84–119.

6. Schreiner, B. F., and Kress, L. C. Untoward results in radiation therapy of uterine cancer when complicated with latent gonococcic salpingitis. Am. J. Roentgenol. & Rad. Therapy, 1924, xii, 51–53.

7. Fränkel, M. Die Bedeutung der Röntgen-Reizstrahlen in der Medizin mit besonderer Einwirkung auf das Endokrine System und seiner Beeinflussung des Karzinoms. *Strahlentherapie*, 1921, xii, 603–638; 850–899.

8. Lenz, M. Investigation of thymus stimulation by roentgen rays. Am. J. Roentgenol. & Rad. Therapy, 1925, xiii, 226–234.

9. Lindig, P. Das Kasein als Heilmittel. Ein Beitrag zur Frage nach dem Wesen und dem wirksamen Faktor der Milchtherapie. *München. med. Wchnschr.*, 1919, lxvi, 921–924.

10. Keysser, Franz. Die Vakzinebehandlung der bösartigen Geschwülste. S. Hirzel, Leipzig, 1923.

11. Theilhaber, A. Der Selbstschutz der Gewebe und die Strahlenbehandlung. *Strahlentherapie*, 1920, xi, 686–691.

12. Voltz, F. Neuere Untersuchungen zur Frage der Radiosensibilität (Prinzipielle Untersuchungen). *Strahlentherapie*, 1922, xiv, 93–96.

13. Wintz, H. Röntgenbehandlung des uterus Karzinoms. Georg Thieme, Leipzig, 1925.

14. Frans-Daels. Rapport au Congres de Bruxelles, Sept., 1921. *Bull. Acad. roy. de Belg., Brux.*, 1921, 328–337.

15. Döderlein, A. Zur Strahlenbehandlung des Krebses. *Zentralbl. f. Gynäk., Leipz.*, 1915, xxxix, 185–189.

16. Healy, W. P., and Bailey, H. Cancer of uterine cervix treated by irradiation; methods of treatment and results in 1,024 cases. *J. Am. M. Ass.*, 1924, lxxxiii, 1055–1056.
Bailey, H. Radium Report of the Memorial Hospital. P. B. Hoeber, New York, 1923.

17. Leland, G. A. J. Massive dose radium treatment in carcinoma of the cervix uteri. Am. J. Roentgenol. & Rad. Therapy, 1924, xii, 373–378.

18. Martzloff, K. H. Carcinoma of cervix uteri, pathological and clinical study with particular reference to relative malignancy of neoplastic process as indicated by predominant type of cancer cell. *Johns Hopkins Hosp. Bull.*, 1923, xxxiv, 141–149; 184–195.

19. Levin, I. Intraperitoneal insertion of buried capillary glass tubes of radium emanation in carcinoma of cervix uteri. Am. J. Roentgenol. & Rad. Therapy, 1924, xii, 352–357.

20. Frank, R. T. The palliative treatment of inop-

erable carcinoma of the cervix by means of radium. *J. Cancer Research*, 1917, ii, 85–102.
21. Regaud, Cl., and others. Traitement des cancers du col de utérus par les radiations statistique de l'Institut du Radium de Paris pour les années 1919–1923. *Gynec. & obstét.*, 1925, xii, 345–347.
22. Coutard, H., and Regaud, Cl. Résultats et technique de la roentgenthérapie dans les cancers du col de l'utérus. *Gynec. & obstét.*, 1925, xii, 344–345.
23. Regaud, Cl. Sur la technique de la curiethérapie dans le cancer du col de l'utérus. *Bull. d. l'ass. franç. p. l'étude du cancer*, July, 1920, 226; Réflexions a propos de la poursuite des localisations excentriques du cancer de l'utérus par la radium puncture abdominale. *Ibid.*, June, 1921, 285.
24. Regaud, Cl., Roux-Berger, J., Lacassagne, A., Cesbron, H., Coutard, H., Monod, O., and Richard, G. Curiethérapie des cancers du col des l'utérus. Resultats de l'Institut du Radium de Paris pour les années 1919, 1920 and 1921. *Arch. d'électric. méd.*, 1923, xxxiii, 289–296.
25. Regaud, Cl., and Mutermilch, S. Influence de l'infection microbienne secondaire sur les résultats de la radiothérapie des cancers, notamment du cancer cervico-utérin. *Compt. rend. Soc. de biol.*, 1922, lxxxvii, 1264–1266.
26. Regaud, Cl. Observations rétrospectives d'essais négatifs de serothérapie anticancéreuse. *Lyon méd.*, 1907, cviii, 231–235.
27. Dechambre, S. De la technique de la curiethérapie par les voies naturelles dans le cancer du col utérine. Paris, 1923.
28. Monod, R., and Monod, O. À propos du traitement du cancer cervico-utérin par l'hystérectomie consécutive à la radiumthérapie. *Presse méd., Par.*, 1922, xxx, 113–115.
29. Lacassagne, A. Rayonnement mou et rayonnement dur en curiethérapie du cancer utérin. *Presse méd., Par.*, 1922, xxx, 323.
30. Lacassagne, A., and Monod, O. Les caryocinèses atypiques provoquées dans les cellules cancéreuses par les rayons x and γ et leur rôle dans la regression des tumeurs malignes irritables. *Arch. franç. de path. gén. et expér., Par.*, 1922, i, No. 1, 1–32.
31. Rubens-Duval, and Lacassagne, A. *Arch. franç. de path. gén. et expér., Par.*, 1922, i, No. 4.
32. Regaud, Cl. Traitement des cancers du col de l'utérus par les radiations: Idée sommaire des méthodes et des résultats; indications thérapeutiques. *Imp. med. & sci., Brux.*, 1926.
33. Greenough, R. B. Treatment of malignant diseases with radium and x-ray; cancer of the cervix. *Surg., Gynec. & Obst.*, 1924, xxxix, 18–26.
34. Schmitz, Henry. End-results of treatment of cervical carcinoma with radium and roentgen rays. *J. Am. M. Ass.*, 1925, lxxxiv, 81–84.
35. Taylor, H. C., and Peightal, T. C. End results of 201 cases of carcinoma of cervix. *Am. J. Obst. & Gynec.*, 1924, viii, 288–297.
36. Ward, G. G., and Farrar, L. K. P. Radium treatment of carcinoma of cervix uteri; results at the Woman's Hospital after 5 years. *J. Am. M. Ass.*, 1925, lxxxv, 159–163.

CARBON ARC AND FLAME LAMPS IN MEDICINE AND SURGERY

BY HERMAN GOODMAN, B.S., M.D.

NEW YORK CITY

INTRODUCTION

SINCE the use of carbon arc and flame lamps in medicine and surgery is on the increase, it has seemed interesting to review the physical and historical background of the subject. It is hoped that modern phototherapy will fill a void in the field of therapeutics. In the meantime, these historical chapters may be found of value.

HISTORY OF PHOTOTHERAPY

The virtue of sunlight was known to the ancients. The Old Testament mentions a long line of sun worshippers. Greek and Roman students of the philosophy of medicine made deliberate use of sunlight. The Greeks were in the habit of exposing themselves, unclad, on the roofs of their dwellings for sunbathing as health measures.

We can refer to Hippocrates, the Father of Medicine, who lived about 400 years B.C. on the island of Cos, in the Greek Archipelago. A great Health Temple was erected to Aesculapius, god of the sun, medicine and music. This temple was rediscovered recently, and the remains excavated. We are told that the priests in the temple were also physicians. The natural agencies of air, light, and water were used in the cure of disease, and in the pursuit of both physical and mental culture. Recall that Greece at this period produced the greatest athletes, philosophers and poets of any known civilization. The beauty of the classic Greek form, both male and female, has not been equalled since. The temple, known as the Aesculapion, was built a little inland from the sea on the slopes of a range of mountains,

which faces south and was some 300 feet above sea level. Its situation gave it the maximum of sunlight and pure fresh air.

The Romans made the sun an object of adoration. During the reign of Constantine there was widespread worship of the sun. Vestruvius and Cicero mention that the Romans indulged in the sunbath followed frequently by cold sponging of the body surface. Later, the Romans erected special buildings for the purpose, called solaria.

Herodotus advised sunbaths for those whose muscles were weak and flabby. Antyllus gave details as to the effect of sunbaths on the system. Both these authorities recommended sunbathing for skin diseases. Others endorsing sunlight were Plinius, Oribasius, Aetius and Porta.

Curiously, history details that the Egyptians were sun-worshippers, on one hemisphere, and on the other side of the world, the natives of South and Central America took sunbaths. Thorndike beautifully relates the influence that light and the sun played on the emotional nature of man during the first thirteen centuries of the Christian Era.

During the 18th century, we find that solar rays were utilized by Faure for ulcers (1---). In the next century, Hufeland is said to have used sunlight in the treatment of rachitis. Leaders in this work of sun therapy include Bertrand, Leconte, Loebel, Molschott, Edwards, Cauvine, Dobereiner, Ernst and Sneigirew.

The first German solarium, probably the first in the world, was built in 1840. In the same year Ollier and Poncet published "Treatment of Tuberculous Arthritis by Sunlight." Bonnet advised general body radiation by exposing not only the area to be treated but the entire torso. Arnold Rickli published an article on "Atmosphere Cure" in 1855. During and after the war of 18-0, various battle wounds were treated by exposure to sunlight.

Loebel set forth in definite terms the conditions in which treatment by light would be beneficial, and those in which sun therapy was to be avoided.

PHOTOTHERAPY

Definition. (G. phos (phot-), light Therapeia, treatment). In its largest sense, phototherapy implies the treatment of disease by means of light rays. With our modern conception of light this embraces the visible and invisible light rays, from the shortest rays of radium and the roentgen ray, through the ultraviolet into the visible spectrum and beyond the visible spectrum into the infra-red zone, and the high frequency currents of d'Arsonval and Oudin. For practical purposes, and by convention, phototherapy implies the utilization of visible light and the zones beyond it in the infra-red, and most commonly, the ultraviolet.

Physics. To appreciate the importance of this work, it is necessary to go back to 1666 for Newton's fundamental experiment on the spectrum. Newton caused a pencil of direct sunlight to enter a darkened room through a hole in the shutter. It formed an image of the sun on the opposite side of the room, the room acting as a pinhole camera. Newton then placed a glass prism inside the room close up to the hole with its refracting edge horizontal and pointing downward so as to receive the pencil. The latter, as was to be expected, was refracted upwards by the prism. But instead of forming a single image of the sun in its natural colors higher upon the wall, it formed a vertical colored strip to which Newton gave the name of spectrum.

The colors of the spectrum were, according to Newton, red, orange, yellow, green, blue, indigo and violet, in order of increasing deviation. They pass imperceptibly into one another, through intermediate tints, and are not marked off by sharp boundaries. One should remember that the red end of the spectrum is deviated least. The prism refracts radiation of a higher frequency more than a lower frequency.

From this experiment, Newton inferred that white light is composite, and that in decomposing it by a prism we are getting something simpler and more elementary. Also that the refractive indices of the different colors have slightly different values; hence, they are bent up to a different extent on entering the prism, and on leaving it the angles of divergence between each successive pair are further increased. In other words, the white light undergoes dispersion, as it is called, in the prism, ow-

ing to the difference in refrangibility of its constituent rays.

In order to show that the prism did not produce the colors, but that it separated colors that were already existing, Newton performed other experiments. From one of these, one part of the spectrum was allowed to pass through a slit in a cardboard, and this part, for example the green, was again allowed to fall on a prism. No further decomposition of the light was found. The green rays remain green after passing through a second prism, and the patch of light on the second cardboard is wholly green. Thus the green rays of the spectrum form something elementary which cannot be decomposed further. The same holds true of all the other colors of the spectrum.

Light of a definite position in a spectrum and hence of a definite color is called monochromatic. This was confirmed by an experiment with crossed prisms. Further, Newton proved that not only can white light be decomposed into the colors of the spectrum, but that the latter can be recombined to form white light.

It should be recalled from what has just been written, that Newton had a spectrum which was limited by red at one end, and by violet at the other. This was, and is, the visible spectrum, in other words, colors which the human eye is organized to pass into consciousness for those who have sight.

Since Newton's time much work has been done, and much has been learned. A complete field millions of times broader than the octave of visible light has been uncovered. For our purpose, we are most interested in two zones close to the octave* of visible light which lie in what is called by so contradictory a term, invisible light. These zones are the infra-red and the ultraviolet. These terms are sanctioned by long usage. They have crept into our literature and it seems best to use them.

The infra-red zone was discovered by William Herschel in 1800. He placed the bulb of a sensitive thermometer on a spectrum and found that the rays falling on it produced a rise in temperature. To make sure that the rise in temperature was actually due to the rays falling upon it, two other thermometers were placed in the shade near the spectrum; it was found that they showed no rise in temperature. The rise in the temperature was much greater at the red end of the spectrum than at the violet end. When placed beyond the violet there was no heating effect, but when the bulb of the thermometer was placed beyond the red there was a marked rise in the temperature. The interpretation of the experiment is that the sun's rays carry energy with them which is converted into heat when it falls upon the bulb of the thermometer; that the heat of the violet rays of the spectrum have the least energy, and that there is a zone beyond the red end of the visible spectrum which carries energy. Other investigators, including Ampere, studied the infra-red more completely.

A thermometer can be used for detecting heat rays only in the case of an extremely powerful source of light. The thermopile must be used otherwise. In using the thermopile, the rays are allowed to fall upon the junction of two different metals in an electric circuit and the current set up is proportional to the rise of temperature. In this way, rises of temperature as small as one millionth of a degree Centigrade can be measured.

Rays beyond the visible end of the spectrum were noted by their chemical action of converting silver chloride into metallic silver in 1--- by Scheele. These rays came to be called "actinic" or "chemical" rays, as they were supposed to be necessary before any chemical reactions could take place.

This has been proven to be erroneous. Ritter in 1801 is generally given credit for the discovery of the ultraviolet. Young proved that the rays which caused this reaction were beyond the range of the human eye. The interchange of the terms, chemical, actinic and ultraviolet must be criticized, and justifiably so. In 1809, Guy Lussac and Thénard, noted various effects of light on chlorine and on hydrogen. In 1815, Planché noted the effect of light upon many metallic salts.

Photography has taken its place because of the work on light. Scheele, Ritter and

*Octave is interval between a particular wave length and the next double, or half its number, thus: 3600 — 7200; 3600 — 1800.

others paved the way. Niepce and Daguerre produced the first practical process in 1830. In return, so to speak, we can investigate light through the agency of photography. The part of the spectrum which lies beyond the visible violet zone can be directly observed by means of photography. In 1842, Becquerel made a definite advance by employing a daguerreotype plate to record the spectrum produced by the glass prism. He succeeded in obtaining pictures showing an increase in the length of the solar spectrum to the neighborhood of a line which is called "p," that is to a wave length of 3400. At the same period J. W. Draper also photographed the solar spectrum, employing a plane grating ruled on glass in the place of the prism.

The greatest stride in the region of the ultraviolet was made by Stokes, who by using proper precautions was able to follow the sun's spectrum to the line "p" with the eye, a result subsequently confirmed by Helmholtz. He introduced three new methods of observation. Stokes substituted the fluorescent screen for the daguerreotype plate, replaced glass prisms and lenses by a system of quartz, and used light from an electric arc instead of the sun as a source. It seems probable that Stokes observed the strong line in the aluminum spectrum near wave length 1850 Å.

Miller noticed the transparency of water, quartz and fluorite in the ultraviolet, and observed the transmission band of silver.

On the physiologic side, other investigators were adding to the fund of knowledge on ultraviolet light.

Duclaux in 1885 said that sunlight was the best, cheapest and most universally applicable bactericidal agent. Downes and Blunt, in 18-8 showed the effect was due almost exclusively to the chemical rays. Graber in 1883 had noted that when earthworms (lumbrici) were placed in a box covered with strips of different colored glass—using the colors of the spectrum—the worms always crawled to the darkest places, namely under the red glass. Dubois, in 1890, showed that proteus, an animal like the earthworm preferring darkness, was least comfortable in white light.

Sunburn of animals occurred only on non-pigmented parts. The erythema solare of man is likewise limited to non-pigmented areas. Charcot, in 1859, expressed the opinion that the chemical rays caused erythema solare. Unna in 1885, Woodmark in 1889 and Hammer in 1891 demonstrated that the chemical rays of the spectrum, and particularly the ultraviolet rays were not responsible for explorers in the arctic regions and tourists to the glaciers suffer severely from sunburn even in zero weather, because of the strong reflection of the sunlight on the fields of ice.

The deleterious action of light was not missed. It was definitely known that the sun's rays were active in certain diseases of the skin. Erythema solare was common enough. Then further, it was common knowledge that the sun rays were unfavorable toward other diseases. As early as 1832, Picon of New Orleans published a book in which he mentioned that some soldiers confined to dark dungeons during an epidemic of smallpox contracted the disease, and recovered without suppuration or scarring. In 186- and 18-1, some English physicians, Black, Barlow and Waters, had published articles noting the action of light upon smallpox, but little attention was paid to them.

We have come to the basis of Finsen's clinical work on light. The path has been a circuitous one in order to approach the problem properly. The basis of light therapy must always depend on a knowledge of the physics of the light source, and the physiology of the living matter exposed to it. The advance for which Finsen must be honored is this: He was the first to suggest that all the rays of the sun were not of equal value in therapeutics. He was certain from his experiments that the ultraviolet rays were the effective ones.

In 189-, Finsen gave the world his epoch-making paper on "The Treatment of Lupus Vulgaris by Concentrated Chemical Rays." He had used this form of treatment since 1895. Finsen had begun with concentrated sunlight. The first apparatus used was one for concentrating sunlight. It consisted of a hollow plano-convex lens, 20 to 40 centimeters in diameter, filled with water colored blue (later the blue was omitted). The apparatus stood on a forked

stand; the treatments were prolonged, and were in the open air.

The sun's rays were not always available, and Finsen devised a mechanism to utilize the voltaic arc. The rays are divergent, unlike the parallel rays of the sun, and a different contrivance somewhat like a telescope, consisting of two cylinders, each containing two plano-convex lenses, was built. Two lenses, close together at the outer end of the outside tube, caused the divergent rays to become parallel. Two other lenses were so arranged as to make the paralleled rays become convergent in a cone, which was allowed to fall upon the part under treatment, but not at the focus. Between the two latter lenses there was a layer of distilled water, and outside at the end to the patient, a light filter which was discarded. The intensity of the arc varied from 35 to 50 amperes. The apparatus was suspended from the ceiling of the room and to economize the electric current, four tubes were placed about the arc light at angles of 45 degrees, so that four patients could be treated at the same time from one lamp. During 189-, Finsen made several improvements on his apparatus. He used an arc light of 80 amperes. The lenses were constructed of quartz (rock crystal). Cold water was circulated through the cooling chamber. A hollow compressor was devised consisting of a plate of quartz and a plano-convex quartz lens set in a conical ring. A space was provided for a constant supply of cold water. The pressure which could be exerted, drove the blood out of the part.

Finsen was fortunate in having his projects accepted by several rich Danes, who opened an institute for him to continue his work. Royalty of several countries helped the cause. Light institutes were organized under their patronage in Russia, England and elsewhere. The Nobel prize was awarded to him in 1903. When accepting the award in December of that year, Finsen remarked: "They gave it to me this year because next year would have been too late." His words were prophetic. On September 24, 1904 Finsen gave up. It is said that he kept himself alive to keep working but despite his interest in his own maladies, despite the periods of enforced rest, despite the interest he took to stay with his work, a heart whose membrane had been slowly ossifying beat its last. But a few days before the end, Finsen requested that an autopsy be done in order that even in death, he might serve the profession.

It is not possible to measure the results of Finsen's work. His ideas initiated the modern phase of therapy by light. His own contributions may be overshadowed, but to him belongs the glory of the pioneer. His apparatus may be surpassed, but he devised the first source of artificial light for the treatment of the sick. Finsen may not have known all there was to know, but he lived in an age prior to the discovery of radium, he lived in the time prior to the modern physics.

DEVELOPMENT OF CARBON ARC LIGHT SOURCES

THE ARC LAMP

Opening a knife switch slowly in a "live" circuit causes the current to flash across the gap, even after the two members of the switch are separated. Opening a switch in this manner is not good practice, because the high temperature of the arc melts or burns the contacting members of the switch. It is for this reason, incidentally, that all standard electric light switches, such as are used in the home, open and close with a "snap," making and breaking the circuit quickly in order that the drawing of an arc and consequent deterioration of the contact surfaces may be avoided. The use of an arc passing through the gap between two electrodes was the basis of the first practical electric arc lamp.

Early electrical experimenters learned that if two carbon rods were connected in an electric circuit and the circuit was closed by touching the tips of these rods together, upon separating the carbons, the current continued to flow across the gap, forming an arc which produced light. This phenomenon was first demonstrated on a large scale by Sir Humphrey Davy, who, early in the nineteenth century, used a battery of 2000 cells and produced an arc between charcoal points 4 inches apart.

In order to operate an arc lamp, the electrodes, across which the arc is maintained, must first be brought together to allow the current to start to flow and then separated slightly so as to draw the arc. The carbon points become very hot when current is flowing across the gap, the positive one being raised to a temperature of from 3000° to 3500° C. (approximately 5400° F. to 6300° F.). At this temperature the carbon points are worn away by vaporization or consumed by the passage of the current, and the arc becomes longer and longer until the circuit is finally broken down.

In order to make a practical arc lamp, it was necessary, first, to devise a mechanism which would bring the carbon points together automatically when the current was turned on; second, to separate the carbons automatically in order to form the arc immediately after the current began to flow; third, to feed the carbons as fast as they were consumed so that the points would not become so widely separated as to extinguish the arc. In certain types of arc lamps, it is often customary to feed the carbons by hand rather than to rely on an automatic mechanism for their continued operation.

The type of arc lamp called the open arc was operated with the arc exposed to the atmosphere. Another type was the enclosed arc lamp in which the arc was lengthened and surrounded by an enclosing globe covered with a cap which tends to surround the arc with air from which the oxygen had been burned. By excluding oxygen, the consumption of the carbons was greatly retarded, and the arc was steadier, but the lamp, though it distributed the light much more satisfactorily, did not give as great a candlepower for the same wattage as the open type arc.

While in the original carbon arc lamp, the arc itself gives off some light, perhaps 90 per cent of the light is obtained from the heated carbon points. Later developments were made to obtain more light from the arc itself. It was found that when the carbon electrodes were impregnated with certain salts, the arc became highly luminous, and for a given amount of electrical energy the so-called flame-arc lamp furnished considerably more light than did the ordinary carbon type of arc.

More light from the arc itself was also obtained by using electrodes of materials other than carbon, a notable example being the magnetite arc. The magnetite arc has a copper segment for one electrode and a magnetite stick as the other. A magnetite arc is of high efficiency, and since the electrodes are not consumed rapidly, the lamps do not require frequent trimming. The light from this lamp is white in color.

Magnetite arc lamps operate only on direct current, which in practice is usually supplied from alternating current by means of mercury-arc rectifiers, which change the current from alternating to a pulsating direct current. The use of magnetite arcs is confined to constant current circuits, which in practice are usually supplied at values of 6.6, and 4.0 amperes.

The art of carbon arc and flame lamp making has advanced decidedly. In addition, the carbons used have been impregnated with various salts, or are cored to emit particular zones of the spectrum in excess. It is absolutely essential to the proper understanding of the later discussion to know the difference between a carbon crater arc, and a carbon flame arc. Finsen, and his followers used carbon crater lamps. The direct current was forced through large carbon electrodes, the upper positive pole being twice as large as the lower negative pole. A crater was formed in the positive carbon and it was the crater which was the source of illumination. In our modern lamps, the carbons are impregnated. The carbons may be of the same diameter for positive and negative. The lamps operate equally well on alternating or direct current. The light comes from the crater only to a small degree. The flame formed between the carbons from the gases given off is the important source of light for therapy.

The story of the carbon arc, as far as we are concerned in therapeutics, begins with Finsen's use of the crater lamp utilizing positive pole large diameter carbon as the upper, and negative smaller diameter carbon, as the lower electrode with 30 to 80 amperes of direct current electricity through the poles.

The crater lamp with the pure carbon electrodes gave a variable quantity of ultraviolet, and a perusal of the history of the Finsen apparatus shows that in the earliest work, he used glass condensers, so that a great part of the ultraviolet generated never reached the patient. Later in his work, Finsen substituted quartz crystal for the glass. Of course, much work has been done since Finsen's experiments. Another type of lamp was devised for general body exposure; a smaller model of the Finsen lamp was formed. Other lamps on the Finsen-Reyn idea of carbon lamps were patented, as the Lortet and Genoud; and the London Hospital lamp. Kjeldsen introduced the Dermolampe-iron arc.

Landecker, a gynecologist, with the assistance of Steinberg, a physicist, devised a lamp of carbon arc type which was small, and suited the purposes of Landecker, who had primarily in mind the treatment of body orifices, as well as the body surface.

The feature of the modern flame lamp is the utilization of metal and chemical impregnated carbons which on the operating amperage and voltage of the lamp gives a limited range of radiation.

This is a step in the right direction. For, if any feature of modern carbon arc and flame lamp therapy is appealing, it is the feature of control of radiation through the quality of the impregnated carbons employed, and the mechanical features of the apparatus, as amperage, voltage, and the relation of both these to the cross section diameter of the carbons utilized.

We have thus advanced far beyond Finsen. We have approached an ideal light therapy. It is too long and complicated a story to relate at this place, but the evidence points to the conclusion that we have for the most part been too anxious to judge our therapeutics by the erythema resulting from the exposure. On the modern basis, one now employs impregnated carbons which are designed to give emissions within known bands. We may limit the greater radiation from the light source to the limits of sunlight. We may go further into the near ultraviolet than the sunlight at sea level goes.

Although the shorter wave lengths of ultraviolet are present in the same emission, these are quantitatively at a minimum.

A most important result of the modern prescription type of radiation is the possibility of giving prolonged exposures without fear of marked erythema, or vesiculation. Thus if we prescribed radiation of wave lengths longer than 3200 Å. there would be no possibility of irritating wave lengths reaching the skin surface. Time as an element in our light therapy has been neglected. We have been forced to use exposures as short as one or two minutes with certain radiations. With prescription carbons, the time may be extended to several hours, if indicated.

The modern arc or flame lamp should be easy to operate. Adapters for body orifices may be required in certain work. Low amperage arcs are needed to make possible the use of some lamps on ordinary house circuits. Ease in renewing carbons is essential. The physician or surgeon who undertakes the use of the carbon arc or flame lamp should study the underlying physics, get an analysis of the spectral emission under varying operating conditions and should recall that time and distance play important parts in therapy with these modalities.

I am certain that the future of therapy with light is indeed bright. There is a healthy interest in physiotherapy. In great measure, light is a leader, and with understanding of the principles more physicians will use it.

Vol. XVII, No. 3

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

Editor: ARTHUR C. CHRISTIE, M.D.

Editorial Board: JAMES T. CASE, M.D. H. K. PANCOAST, M.D. WILLIAM DUANE, PH.D.

Advisory Board for Pathology: JAMES EWING, M.D. EUGENE OPIE, M.D. A. S. WARTHIN, M.D.

Collaborating Editors: The Officers and Committee Members of the Societies of which this JOURNAL is the official organ, whose names appear on this page, are considered collaborating editors of this JOURNAL. *Foreign Collaborators:* A. BÉCLÈRE, M.D., PARIS. GÖSTA FORSSELL, M.D., STOCKHOLM. G. F. HAENISCH, M.D., HAMBURG. ROBERT KNOX, M.D., LONDON. R. LEDOUX-LEBARD, M.D., PARIS.

Publishers: PAUL B. HOEBER, INC., NEW YORK

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 1909 Massachusetts Ave., N.W., Washington, D.C. Office of publication, 76 Fifth Avenue, New York.

Information of interest to all readers will be found on page ii.

Officers and Standing Committees

THE AMERICAN ROENTGEN RAY SOCIETY

President: P. F. BUTLER, Boston, Mass.; *President-Elect:* A. HOWARD PIRIE, Montreal, Canada; *Vice-President:* E. L. JENKINSON, Chicago, Ill.; *Secretary:* CHARLES L. MARTIN, 701 Medical Arts Bldg., Dallas, Texas; *Treasurer:* WILLIAM A. EVANS, 10 Peterboro St., Detroit, Mich.; *Librarian and Historian,* H. W. DACHTLER, Toledo, Ohio.

Executive Council: E. H. SKINNER, Chairman, 1020 Rialto Bldg., Kansas City, Mo., WILLIAM DOUGHTY, Cincinnati, O., G. W. GRIER, Pittsburgh, Pa., P. F. BUTLER, Boston, Mass., A. C. CHRISTIE, Washington, D. C., CHARLES L. MARTIN, Dallas, Texas, WILLIAM A. EVANS, Detroit, Mich.

Committee on Laws and Public Policy: B. R. KIRKLIN, Chairman, Rochester, Minn., FRED M. HODGES, Richmond, Va., WILLIAM E. CHAMBERLAIN, San Francisco, Calif.

Safety Committee: P. M. HICKEY, Chairman, University Hospital, Ann Arbor, Mich., H. K. PANCOAST, Philadelphia, Penna., W. D. COOLIDGE, Schenectady, N. Y., A. U. DESJARDINS, Rochester, Minn., H. J. ULLMANN, Santa Barbara, Calif., B. H. NICHOLS, Cleveland, O., G. E. RICHARDS, Toronto, Can., R. R. NEWELL, San Francisco, Calif.

Committee on Scientific Exhibit: LAWRENCE REYNOLDS, Chairman, 10 Peterboro St., Detroit, Mich., J. E. PANNETON, Montreal, Canada, W. A. WILKINS, Montreal, Canada.

Publication Committee: WILLIAMS A. EVANS, Chairman, Detroit, Mich., C. L. MARTIN, Dallas, Texas, G. W. GRIER, Pittsburgh, Penna.

Member, National Research Council: H. K. PANCOAST, Philadelphia, Pa.

Member, American Board of Registry of Radiological Technicians: E. S. BLAINE, Chicago, Ill.

Editor: A. C. CHRISTIE, 1909 Massachusetts Ave. N. W., Washington, D. C.

Editorial Board: JAMES T. CASE, H. K. PANCOAST, WM. DUANE.

Advisory Board for Pathology: JAMES EWING, EUGENE OPIE, ALDRED S. WARTHIN.

Publishers: PAUL B. HOEBER, Inc., 76 Fifth Avenue, New York City.

Twenty-eighth Annual Meeting: Montreal, Can., Sept. 20–23, 1927.

THE AMERICAN RADIUM SOCIETY

President: ALBERT SOILAND, 1407 S. Hope St., Los Angeles, Calif.; *President-Elect:* C. F. BURNAM, Baltimore; *First Vice-President:* BURTON LEE, New York City; *Second Vice-President:* E. H. SKINNER, Kansas City, Mo.; *Secretary:* E. C. ERNST, St. Louis; *Treasurer:* S. M. WITHERS, Denver.

Executive Committee: JAMES T. CASE, Chairman, Detroit; WM. S. NEWCOMET, Philadelphia; DOUGLAS QUICK, New York City.

Program Committee: C. F. BURNAM, Chairman, Baltimore; BURTON J. LEE, New York City; E. C. SAMUEL, New Orleans.

Publication Committee: HENRY SCHMITZ, Chairman, Chicago; E. C. ERNST, St. Louis; H. H. BOWING, Rochester, Minn.

Standardization Committee: G. FAILLA, Chairman, New York City; HENRY J. ULLMANN, Santa Barbara, Calif.; S. M. WITHERS, Denver.

Twelfth Annual Meeting: Washington, D. C., May 16 and 17, 1927.

Committee on Arrangements: TRUMAN ABBE, Chairman, Washington, D. C.; C. AUGUSTUS SIMPSON, Washington; ERNEST N. DORSEY, Washington.

EDITORIALS

"RADIATION-PHOBIA"

THERE has recently been apparent in the literature a tendency to exaggerate the dangers attendant upon roentgen and radium therapy which, in the experience of many radiologists, has resulted in an increased fear of these agents on the part of both the general medical profession and the laity.

It is safe to say that increasing experience has minimized untoward effects of the roentgen ray and radium and that today the benefits to be obtained from radiation therapy in the hands of skilled radiologists far outweigh any possible damaging effects. Everyone who does radiotherapy must keep in mind continually the harmful possibilities inherent in this method of treatment, but it must be recognized that in malignant disease the hope of prolonging or saving life may often require such dosage that damage to normal structures cannot be avoided, and is by far the lesser of two evils. The efforts of radiologists to warn colleagues of every possible danger must not be permitted to deprive patients suffering from cancer of the benefits to be derived from radiotherapy.

Attention should be called to the fact that many of the damaging effects of radiation have been determined by experimental work upon small animals and that when the size of the animal, thickness of overlying tissues, and the total dosage are taken into consideration the conditions are entirely different from those which prevail in the treatment of human beings. For example, Martin and Rogers have called attention to the damaging effects to the intestines in dogs, yet thousands of patients have been successfully treated for abdominal lesions without producing any ill effects, as judged by immediate symptoms or subsequent histories. Doub has written of the damaging effects upon the kidneys, and yet radiotherapists of wide experience never see any symptoms nor urinary changes following radiotherapy. Of course relatively few disease conditions demand treatment over the kidneys, and possible damage to these organs is therefore of little practical moment.

An editorial in this Journal in December, 1926, reviewed our knowledge of the pleuropulmonary changes which may result from irradiation of breast cancer. There is no doubt that these changes do occur and more frequently than is commonly supposed where massive doses are used. As was stated in that editorial it is possible to arrive at an accurate diagnosis of roentgen pleuropneumonitis only if "careful clinical records be kept and satisfactory roentgenograms of the chest be obtained *prior to treatment* and at *frequent intervals thereafter*." A further statement made in that editorial should be kept in mind in connection with the subject of the present editorial, viz.: "The fact that roentgen rays are capable of producing marked structural changes and alteration of function of internal organs, with relatively slight surface effects, in no sense contraindicates their use as a therapeutic agent. On the contrary, it lends encouragement to their continued use, but emphasizes the necessity for caution."

Every roentgenologist knows from experience that there is an ever present tendency to ascribe every symptom or complication that arises during irradiation to the treatment itself. (One patient learned from a jeweller that the *x*-rays had loosened the diamonds in her ring; a dentist suggested to another patient on the day following her first *x*-ray treatment that the *x*-rays were damaging her teeth!)

Exaggerated fears of the dangers of radiotherapy and the ascribing of every symptom that arises during such treatment to the treatment itself leads to numerous harmful results, viz.: The neglect to investigate the true cause of the symptoms and thus to prolongation of the condition causing the symptoms; it makes the patient

more apprehensive, causes loss of sleep and appetite and thereby lowers the patient's resistance; it often causes interruption of the treatment at a time when most good can be done by irradiation; it even prevents patients from taking the treatment, thereby depriving them of its benefits; it leads the radiotherapist to give too little treatment for fear of criticism; and it may also lead to threats of damage suits or other legal proceedings.

It is possible at any time for statements in our own scientific papers to be used against us, especially when quoted in fragments, greatly to the detriment of radiation therapy. We should therefore be careful to qualify all statements as to damaging effects in such manner as to express the real truth and not to cause unnecessary alarm.

G. E. Pfahler, M.D.

THE OCCUPATIONAL HAZARD OF THE RADIOLOGIST

An editorial in the *Journal of the American Medical Association* of Feb. 19, 192-, on the "Natural and Mental Hazards of the Radiologist" discusses a very important and timely subject. Its concluding paragraph is as follows:

"The 'accidents' resulting from insufficient knowledge and protection during the early years of roentgenology are responsible for the prevalent idea that the radiologist is constantly exposed to great danger. Under present conditions this danger is greatly exaggerated in many quarters; indeed, there is a tendency on the part of many physicians ill informed as to the effects of radiations on the body to ascribe any illness of a radiologist or other person working in radiology to the effect of irradiation. This is so common that disturbances of the blood due to infection of accessory sinuses or of other structures, the lack of children in the family, or cancer, are forthwith attributed to the effect of the rays, without any reference to the conditions under which such disturbances have arisen, and without investigation. Many radiologists themselves have a tendency to ascribe slight disturbances in the corpuscular elements of their blood to the effect of irradiation, without consideration of other factors which might be responsible, such as the common practice among roentgenologists of spending considerable time in a dark room, thus robbing themselves of the benefit of sunlight. If a radiologist has cancer of the stomach, the legend immediately goes forth that it was due to irradiation, regardless of the fact that cancer of the stomach or other internal organs is not more prevalent among radiologists than it is among persons who have never been exposed to roentgen or radium rays; these do not have any more to do with the incidence of internal cancer than rainfall with the growth of hair. External cancer in a radiologist or other person working with radioactive substances may or may not be caused by roentgen or radium rays. This depends on the conditions surrounding the activities of each individual concerned, and cannot be settled on mere *a priori* reasoning. To assume that cancer of internal structures or any other common pathologic disturbance in a radiologist must be due to radiations is to assume sheer nonsense."

One of the important results of the idea that radiologists are still subject to unusual liability to injuries to the skin and to subsequent development of carcinoma is the general policy of life insurance companies to consider radiologists abnormal risks.

We believe that injustice has been done to many radiologists by pursuit of this policy.

There is no statistical proof that the radiologist who works under modern conditions of protection has a higher mortality or morbidity rate than do physicians in general. Aside from statistics, it is the general observation of those who are intimately acquainted with radiologists in this and other countries that injuries attributable to irradiation are found only in those older men who worked under pioneer conditions of little or no protection. The risk of the radiologist is now quite comparable to that of the surgeon. The inexperienced or careless surgeon is subject to constant risk of infection just as the careless worker with the roentgen ray or radium is exposed to the danger of skin or other injury.

The time has arrived when insurance companies should reconsider their policy in this matter. Instead of being based upon high percentage of injuries in the

pioneer days of radiation, investigation should be made to determine the percentage of injuries resulting under modern methods of protection. Until such statistics are forthcoming, in order that injustice may not be done to a large class of men practicing radiology each case should be investigated and passed or rejected on its merits. If the radiologist is known to be a man of experience and skill in his specialty and if it is shown that he works only with the most modern means of protection he should be placed in the same class as any other physician.

It is quite certain that insurance companies are missing the point when they discriminate against radiologists who practice radiology exclusively and continue to insure physicians, dentists and even irregular practitioners who use the roentgen ray or radium as an adjunct to other practice. The great majority of individuals of these latter classes have little or no knowledge of the hazards connected with exposure to irradiation and are in much greater danger of injury than the specialist who has made the practice of radiology his life work.

Subscribers to The American Journal of Roentgenology and Radium Therapy *visiting New York City, are invited to make the office of* The Journal *(76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. Charles L. Martin, Dallas, Texas.
Twenty-eighth annual meeting, Montreal, Can., Sept. 20–23, 1927.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Washington, D. C., May 16–20, 1927.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Robert J. May, St. Luke's Hospital, Cleveland, Ohio.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. E. C. Samuel, New Orleans, La.
Annual meeting, Memphis, Tenn., Nov. 14–17, 1927.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. R. A. Arens, Michael Reese Hospital
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. James H. West, 8314 Euclid Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. Henry L. Ulbrich, 1130 E. Grand Blvd.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. M. C. Sosman, Peter Bent Brigham Hospital, Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. W. W. Belden, 8 West 16th St.
Meets monthly on second Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. S. C. Davidson, Highland Hospital.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary, Dr. Davis Spangler, Dallas, Texas.
Meets April 25, 1927, at the Orndorff Hotel, El Paso, Texas, for the one day only.

British Empire

BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London; W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

RADIOLOGICAL SECTION, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. C. A. Anderson, The Hospital, Dunedin.
Meets at Dunedin, New Zealand, during February, 1927.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

CANADIAN RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Brooks, Montreal.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHOSLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prag, II/52.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Torino, Torino.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs S. A. Reinberg and S. G. Simonson.
Meets annually.
Fifth Annual Meeting in Kiev, Ukraine, May, 1928.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Meets in Copenhagen.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

THE FIRST GRAM RADIUM PACK

To the Editor:

Recent interest in the use of comparatively large amounts of radium or radon in the form of surface packs* prompts me to relate what I believe is the first instance wherein this form of radiation treatment was employed.

The patient, a colored woman, aged forty-six, reported for examination on Aug. 27, 1914.

Examination: Patient is emaciated, having lost 40 pounds during last two months. Has large mass in neck which patient stated started ten years ago. This mass gradually increased in size but gave few subjective symptoms. Probably an adenomatous thyroid. At present this mass is irregular in shape, the right half being much larger than left. Right half also seems to be softer.

The right breast is contracted, hard, indurated and fixed. There is an ulcerating surface (5 cm. in diameter) in lower right quadrant. Right arm and hand greatly swollen and motion limited. There is a large node in right axilla.

The left breast presents a small node to right of nipple. It is freely movable and left axilla seems to be free.

The Wassermann reaction is negative and blood count normal. The roentgen examination gives evidence of mediastinal involvement.

Treatment: Aug. 28, 1914. The case being entirely inoperable, it was decided to try radiation over right breast, shoulder and neck. Having available at this time over a gram of radium in tubes of varying amounts, a somewhat crude pack was arranged, the total amount used being 1020 milligrams. The distance from the skin surface was about 5.5 cm., and the time of application eight hours.

Each tube was screened with 0.5 mm. silver and 1.0 mm. brass. The distance was obtained by using felt pads. The time expressed in gram hours would be 8.16.

Sept. 9, 1914. Marked improvement in general condition. Tumor mass in neck reduced in size. Node in right axilla smaller.

* A gram radium surface pack is now generally considered to mean from 1 to 4 gm. of radium element (or its equivalent of radon) divided into 50 or 100 milligram tubes. These tubes are arranged in some regular form (usually circular) over a given area. The radium tubes are encased in a sufficient thickness of lead (or other suitable metallic material) to absorb all or nearly all the gamma rays escaping from the sides and back of the pack. The face of the pack is open, the necessary distance screening being obtained by an adjustable feature. As a matter of fact, the latest type, which is a permanent one containing a fixed amount of radium, is much like the arrangement used for adjusting a roentgen tube. It is claimed that the radium pack will deliver a concentrated penetrating gamma radiation such as cannot be obtained by any artificially produced gamma rays known at the present time.

Swelling in right arm and hand markedly reduced. Induration in breast lessened. Ulcerating surface dry, odor absent, base presenting healthy looking granulations and epithelial margin seems to be filling in. It is hard to believe that so much local improvement could take place in such a short time.

Oct. 22, 1914. General and local condition so greatly improved that it was decided to risk radical operation on left breast.

Oct. 23, 1914. Radical operation on left breast. Patient did not stand operation well and there was a rapid decline in general condition. Patient died Nov. 6, 1914. No autopsy permitted.

Comment: The improvement in this patient was so marked following the irradiation that it seemed at the time best to operate on the left breast. The importance of noting the blood picture following intensive ray dosage was not then understood. With our present knowledge we would, of course, not have attempted such a radical surgical procedure or have risked the hazard of a general anesthetic, especially if the mediastinal glands seemed to be involved.

William H. Cameron, M.D.
Pittsburgh, Penna.

TISSUE DIAGNOSIS IN THE OPERATING ROOM

To the Editor:

I will consider it a courtesy if you will publish this letter in your journal, as I am anxious to come in correspondence with pathologists and surgeons interested in the immediate examination, by frozen section, of tissue in the operating room and the immediate cover-slip studies of smears from all fluids and pus.

Microscopic examination of stained frozen sections has been possible for more than a quarter of a century. The staining of unfixed frozen sections with polychrome methylene blue and other stains is a well-established procedure. In many operating rooms in university and other large and small surgical clinics, provisions for these immediate diagnostic studies have not only been available, but have been in practical use for years; while, unfortunately, on the other side, this diagnostic part of the operating room is conspicuous by its absence in many clinics.

Before 1915 it was rarely necessary for a surgeon well trained in gross pathology to need a frozen section to help him in diagnosis at the operating table. Since 1915, and especially since 1922, the public has become so enlightened that malignant disease formerly easily recognized either clinically or in the gross, now appears in our operating rooms devoid of its easily recognized clinical and gross appearance and can only be properly discovered by an immediate frozen section. The majority of operating rooms are not equipped or prepared for this new diagnostic test.

The first essential part for this diagnosis is the technician—one to cut and stain the frozen section, or to make and stain the smear. The second is a pathologist trained to interpret it. It is possible for the surgeon to be all three in himself, and some young surgeons are so equipped. In others it is a dual combination—surgeon and pathologist in one, and the technician. More frequently it is three—operator, technician and pathologist. It makes little difference whether it is one, two or three individuals, providing each has the equipment and training for this most difficult diagnostic test.

In the address as chairman of the Surgical Section of the Southern Medical Association, I discussed biopsy, and this paper has been published in the *Southern Medical Journal* for January, 1927 (Vol. XX, page 18). A reprint of this paper will be sent to anyone on request. The chief object of this letter is to come in contact with surgeons and pathologists who are sufficiently interested in this problem to discuss it either by correspondence, or by attending a meeting in the surgical pathological laboratory of the Johns Hopkins Hospital, either the Monday before, or the Friday after the meeting of the American Medical Association in Washington.

Schools for technicians may have to be established in different sections of the country, and the surgical pathological laboratories of the medical schools and the larger surgical clinics should offer courses in

this tissue diagnosis, so that surgeons may learn to become their own pathologists, or pathologists learn the particular needs of the surgeon in tissue diagnosis in the operating room.

It is quite true that when the majority of the public are fully enlightened, the surgeon will see lesions of the skin and oral cavity and the majority of subcutaneous tumors when they are so small that their complete excision is not only indicated but possible without any mutilation. The chief danger here will be a surgical mistake—the incomplete removal of an apparently innocent tumor. There is no necessity here for biopsy. If a proper local excision is done, no matter what the microscope reveals, that local operation should be sufficient. But when lesions of the skin, oral cavity and soft parts are extensive and their complete radical removal mutilating, then there must be biopsy to establish the exact pathology.

In tumors of the breast and disease of bone, for years, the diagnosis could be made clinically, or from the gross appearances at exploration. But now, in an increasing number of cases, the breast tumor must be explored, and the gross pathology of this earlier stage is not sufficiently differentiated to allow a positive diagnosis. Immediate frozen sections are essential to indicate when the complete operation should be done. The same is true of the earlier cases of lesions of bone. The roentgen rays no longer make a positive differentiation between many of the benign and malignant diseases, for example, sclerosing osteomyelitis and sclerosing osteosarcoma.

We must not only specialize in tissue diagnosis, but we must organize this department so it will function properly in as many operating rooms as possible in this country.

Then there is a final and most difficult question to consider. I doubt if it can be settled. What shall be done in those operating rooms in which there is no technician to make the sections and no one trained to interpret the microscopic picture? How can a piece be excised or a tumor removed, for example, from the breast, and this tissue sent to some laboratory for diagnosis without incurring the risk of the delay to the patient. I have discussed this point in my paper on biopsy.

Joseph Colt Bloodgood.
Surgical Pathological Laboratory,
Johns Hopkins Hospital.

PHILADELPHIA ROENTGEN RAY SOCIETY

The Philadelphia Roentgen Ray Society held its regular monthly meeting on Thursday evening, January 6, at the Pennsylvania Hospital. The scientific program consisted of a paper on "The Roentgen-Ray Findings in the Chests of Patients Suffering with Asthma" by Drs. Willis F. Manges and S. J. Hawley. Dr. Hawley read the paper and Dr. Manges discussed it with an excellent lantern slide demonstration. The paper was also discussed by Drs. Pancoast and Wescott. Several members showed interesting films and the meeting then adjourned.

An abstract of the paper by Drs. Manges and Hawley follows:

ABSTRACT

This is a preliminary report of the study of the chests of 157 patients suffering with asthma. The following findings are recorded: General peribronchial thickening 27 per cent; chronic lower lobe infection 23 per cent; tuberculosis 18 per cent; thickened root structures 12 per cent; enlarged heart 3 per cent; emphysema 1 per cent; no findings 16 per cent. A definition of the above terms is included. No effort is made to include disease changes elsewhere, as infection of the nasal accessory sinuses, although the importance of such findings is recognized. It is clearly pointed out that no controversial attitude is intended or raised with the importance of allergic phenomena and their treatment in these patients. The roentgen-ray examination is regarded as the best method of determining the presence or absence of tissue changes in the lungs in the recent state. Such an examination should be of value because a number of these cases show evidence of pathologic change that needs treatment which is not included in the usual management of asthmatics—such as bronchoscopic

drainage in bronchiectasis. Although foreign body cases are not included in this study, emphasis is placed upon the frequency with which foreign bodies in the air passages have led to an erroneous diagnosis of asthma. This is especially true in children.

E. P. PENDERGRASS,
Secretary.

TEXAS RADIOLOGICAL SOCIETY

The Texas Radiological Society will meet on April 25, 192-, at the Orndorff Hotel, El Paso, Texas, the meeting to be for the one day only.

INVITATION CIRCULAR

TO THE EIGHTEENTH CONVENTION OF THE GERMAN ROENTGEN SOCIETY (SOCIETY FOR ROENTGENOLOGY AND RADIOLOGY) ON THURSDAY THE 28TH TO SATURDAY THE 30TH OF APRIL, IN THE PAULINENSCHLÖSSCHEN, WIESBADEN, GERMANY

On Wednesday, April 27, the following committee and special committee meetings will be held in the Kurhause.

10 A.M. Meeting of the General Committee.

2.30 P.M. The physicians' business association of the German Roentgen Society (Chairman, Prof. Haenisch, Hamburg).

5 P.M. Special committee for the adjudication of roentgen injuries and the study of their prevention (Chairman, Prof. Levy-Dorn, Berlin).

Material that may be appropriate for the consideration of these committees should be sent in to the respective chairmen up to April 1. Guests are welcome to these sessions.

The assembly of members will take place on Friday, April 29 at 2.30 P.M.

The sessions of the convention will be held daily from 9 to 12.30 A.M. and from 2 to 5 P.M.

After the close of the Friday afternoon session there will be held a meeting of the roentgenologists who have conducted the sessions.

The convention this year is held in conjunction with the Congress of the German Society for Internal Medicine, and at a joint meeting on April 28 the following subjects will be discussed:

(*a*) The importance of roentgen examinations of the lung and mediastinum in internal medicine. Reviewed by Dr. Dietlen of Homburg, Saar and Dr. Assmann of Leipzig.

(*b*) The importance of the examination technique for the roentgen diagnosis of disease of the mediastinum and of the lung. Reviewed by Dr. Haenisch, Hamburg.

(*c*) On the contrast filling of the bronchi with lipiodol and iodipin. Reviewed by Dr. Lorey, Hamburg.

(*d*) The roentgen diagnosis of interlobar and marginal lobar processes. Reviewed by Dr. Fleischner, Vienna.

On April 29, 192-, the following aspects of the *application of radioactive agents* will be discussed:

(*a*) General physical and technical fundamentals. Reviewed by Dr. Friedrich, Berlin.

(*b*) Biological fundamentals and intracorporeal irradiation (implantation, needle and seed techniques). Reviewed by Dr. Halberstädter, Berlin.

(*c*) External irradiation with the exception of gynecological diseases. Reviewed by Dr. Dautwitz, Amstetten.

(*d*) Gynecological radium treatment. Reviewed by Dr. Eymer, Innsbruck.

Each reviewer will speak about thirty minutes. A limited amount of discussion will be permitted.

The German Society for Internal Medicine permits the members of our society free access to their sessions.

The following reviews have been tentatively planned for:

1. Psychotherapy (Gaupp, Tübingen and Fleischmann, Nassau).

2. The results of recent functional studies on the stomach and duodenum (G. Katsch, Frankfurt a. Main).

RICHARD WERNER,
Chairman.

DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

A NEW ARRANGEMENT OF THE BUCKY DIAPHRAGM FOR VENTRICULOGRAPHY

BY EUGENE P. PENDERGRASS, M.D.

Associate in Roentgenology, University of Pennsylvania

PHILADELPHIA, PENNSYLVANIA

FOR some time it has been our impression that interpretation of ventriculograms could be made more satisfactorily if it were possible to make the films in a proper manner.

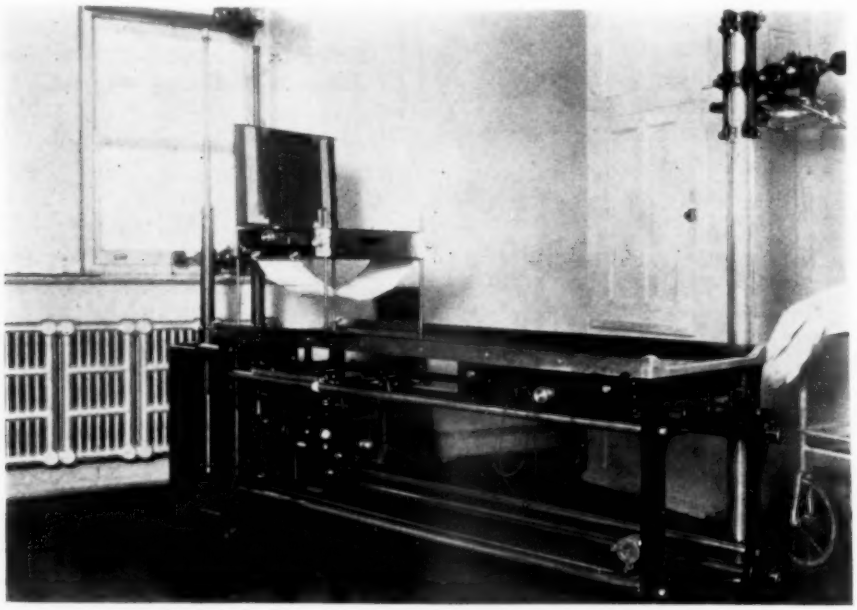


Fig. 1. Demonstrates the Bucky diaphragm on four adjustable legs. The head band is placed as near as possible to the edge of the diaphragm nearest to the shoulder of the patient. The cassette tray of the diaphragm is shown with its retention clamps, which prevent the cassette from falling when the tray is placed in an upside down position. The tube is mounted below the table.

In preparing a patient for such an examination, the neurological surgeon introduces air into the lateral ventricles of the brain after first removing the required amount of cerebrospinal fluid. The patient is then sent to the roentgen department for an examination of the head, which entails lateral stereoscopic films of each side of the head, a posteroanterior film, with the forehead and nose next to the film, and a anteroposterior film, with the occiput next to the film. When such a patient is turned from side to side, the air in the ventricles seeks the upper level. Therefore, if the rays are projected from above the patient, the ventricle furthest away from the film is the one that is filled and has to be interpreted.

To make ventriculograms properly and easier of interpretation, it is therefore necessary to project the rays from below the patient, and the Bucky diaphragm has to be placed above the head of the individual being examined.

Such a Bucky diaphragm should have

the following specifications (see Figs. 1 and 2).

1. The Bucky diaphragm should be mounted on four adjustable legs with rubber protectors, so as to prevent scratching the table top. The legs should be strong enough to prevent movement, and must also be adjustable because of differences in the size of patients.

2. There should be a head band to hold the head firmly, in order to prevent movements during respiration.

3. The tray for holding the cassette has to be arranged so that it can be placed in upside down position and must also be equipped with retention clamps to prevent the cassette from falling. The cassette must be so placed in the tray that it may be as near as possible to the shoulders of the patient, since it is the shoulder that prevents the head of the patient from being placed in the center of the Bucky diaphragm.

4. The Bucky diaphragm should be equipped with a time switch, which, when released, automatically exposes the film to the roentgen rays.

5. The roentgen tube below the table is so arranged that it can be placed in a central position, or for various stereoscopic shifts, depending on the tube target film distance.

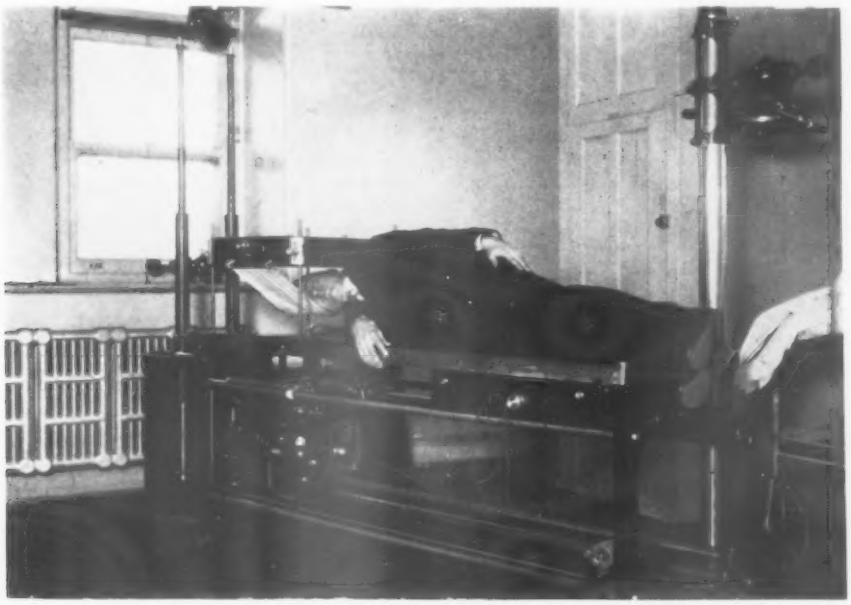


Fig. 2. Illustrates the position in which the patient is placed for lateral stereoscopic films of the head.

Such an arrangement has made it possible for us to make more accurate interpretations of the roentgen films, as by this method the air-filled ventricle is nearest the film. The shadow of the air in the ventricle is more dense and distortions can be more easily seen.

A NEW TYPE APPLICATOR FOR USE IN THE TREATMENT OF MALIGNANCY OF THE CERVIX

BY IRA I. KAPLAN, M.D.

Assistant Therapist in Charge of Service, Bellevue Hospital

NEW YORK CITY

THIS applicator is a modification of the "curie colpostat" in use in the Curie Institute, Paris. It consists of a moulded rubber, elongated, H-shaped appliance of which the ends are cylindrical tubes connected by a rubber covered flexible spring. Individual single rubber cylinders are also used. The accompanying sketch shows more clearly the form and design.

FIG. 1. Photograph of radium cervix applicator, actual size.

The rubber cylinders are 3 cm. long by 1.5 cm. diameter with a central bore 0.5 cm. in diameter, leaving a wall thickness of 0.5 cm. The material is pure metal free gum rubber specially vulcanized to give a spongy resiliency without the sponge absorption quality. The spring is specially tempered flat clock spring, 10 cm. long by 1 cm. wide by 0.2 cm. thick. It is just tense enough to spread the cylinders apart in the vagina, and keep an even pressure against the fornices and cervix. The spring is moulded into the cylinders and covered with the same quality rubber, but is vulcanized so that it is flexible, yet sufficiently non-stretching so as to hold the cylinders together.

These cylinders are stoppered at one end with rubber moulded in place, and the open end when filled with the radium tube is stoppered with removable rubber corks.

This applicator is inserted into the vagina through a large mouthed bivalve speculum. The cylinders are pushed in place on either side of the cervix and the

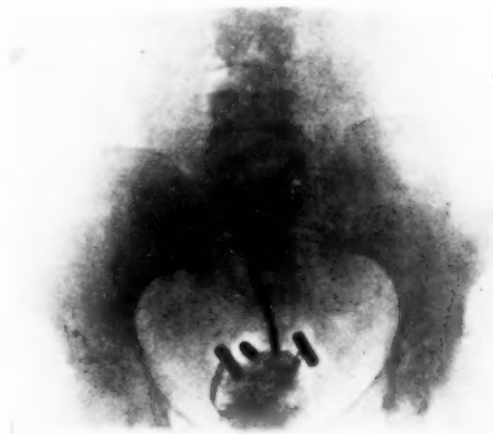


FIG. 2. Roentgenogram showing applicator in place in patient. Cervical applicator and uterine sound.

spring tension keeps it there. The loose cylinders are placed against the cervix in front of the spring. One or more single cylinders may be used depending on the growth of the lesion and the width of the vaginal vault. Gauze packing is then inserted, so that the packing against the middle cylinders is held in place by the spring. Packing is placed between the anterior and posterior vaginal wall and the applicator to protect the bladder and rectum, and then a third packing is placed in the outer vaginal space against the spring holding the whole applicator in position. Crossfiring by the radium in the cylinders is thus accomplished easily on the local lesion and on the surrounding parametria. Before insertion, the applicator is sterilized by boiling, and may be

dipped in boiling paraffin for further protection against absorption.

The advantages of the applicator here described over the old bottle corks "curie colpostat" are:

It is all rubber moulded in one piece. It is sterilized by boiling and can be used over again. It does not absorb vaginal secretions. It is smooth on all sides, presenting no rough edges which cut into the vaginal wall or lacerate the mucosa. It is soft and moulds readily to conform to the body tissue. The cylinders are not tied on with thread and do not come apart on insertion or withdrawing due to the rotting or breaking of the threads. It gives off no secondary caustic radiation and acts as a filter for secondary rays from the radium tubes. It is not expensive. It furnishes a single practical, readily controllable and exact means for crossfire irradiation of the cervix with radium.

SNARE FOR THE ELECTROTHERMIC AMPUTATION OF THE UTERINE CERVIX, PRECEDING RADIUM APPLICATIONS, IN CERTAIN CASES OF CARCINOMA

BY GEORGE E. PFAHLER, M.D.

PHILADELPHIA, PENNSYLVANIA

IN certain cases of carcinoma of the cervix, it seems advisable to amputate the cervix immediately preceding the insertion of radium. The conditions favorable for such procedure probably occur in only a small percentage of cases, such as a large cauliflower growth or much hypertrophy of the cervix associated with a large amount of fibrous tissue which may help to shield the carcinoma cells. In such cases, as much local radiation is needed to destroy the cancer as to cause damage to the vaginal wall, bladder and rectum. Therefore, if such a lesion can be safely and quickly removed by electrocoagulation followed by the insertion of radium into the uterine canal, and by radium applied against the wound, with the vaginal wall thoroughly displaced, it would seem that a definite advance could be made.

FIG. 1. Shows the handle and tube in contact, with the snare open.

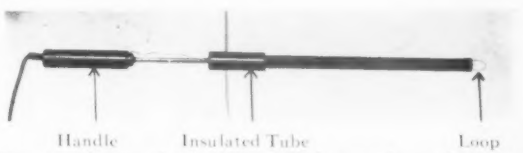


FIG. 2. Shows the handle pulled away from the tube, closing the snare. A hard rubber sleeve covering this gap has been added.

Electrothermic coagulation has been used to advantage in the removal of malignant disease. All small blood vessels and lymph channels are sealed off immediately. Small arteries can be clamped by hemostatic forceps and coagulated in a moment by applying the high frequency current to the forceps held in the rubber-gloved hand. In this way, in a suitable case, the diseased cervix can be removed in a few moments under gas anesthesia. There should be no delay between this operation and the application of the radium, for the congestion which follows any such procedure would furnish increased blood supply and likely lead to more rapid multiplication of the carcinoma cells which are left behind.

Heretofore, the instruments available for such purposes have been, at best, curved needles with which I have tried

to reach behind the hypertrophied cervix or cauliflower growth and separate this diseased tissue. Under such circumstances, however, it is difficult to see behind the lesion for the uterus is often fixed, and there is danger of coagulating the vaginal wall. It seemed, therefore, that if a snare could be developed by which the coagulating wire could be looped around the hypertrophied cervix and back of it, it could be then rapidly closed under the influence of the endothermic current, and thus do no damage to the surrounding tissues. This permits a quick amputation, at times bloodless; at other times, there will be small spurting arteries which can be quickly clamped and sealed off by the endothermic current. The whole procedure is thereby shortened, and the wound is almost instantly sealed by heat and rendered aseptic.

The idea of a snare was suggested by a tonsil snare, but it was necessary to develop a snare of large size that could be closed quickly, and this required more movement than any ordinary mechanical device would give. With the coöperation of my associate, Dr. W. P. Widmann and my mechanic, Mr. Thomas Gallen, we developed the idea of a small brass tube 10″ long and $\frac{1}{4}$″ in diameter, through which a brass rod projects $8\frac{1}{2}$″ long, $\frac{1}{8}$″ in diameter, and continuous with this rod is a loop of No. 2 Buffalo music wire which projects from the distal end of the tube. A new wire is used for each operation and it can be quickly replaced by the operator if necessary during the operation. The operating tube is covered with rubber tubing or hard rubber. At the proximal end of the rod, there is an insulated handle containing the rod which carries the current. A hard rubber sleeve covers the joint between the insulated handle and the insulated tube. This permits the operator to hold the tube safely in one hand and the handle in the other while he gently pulls them apart, thus closing the loop as the current cuts through the tissue (Figs. 1 and 2). This has been made up rather crudely, but it works. It can be improved upon, at least in appearance, by covering the tube with hard rubber, and the tube which is carried into the vagina can probably be made smaller.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

SCOLIOSIS, ROTARY LATERAL CURVATURE OF THE SPINE. By Samuel Kleinberg, M.D., F.A.C.S., Assistant Surgeon, New York Hospital for the Ruptured and Crippled; Chief of Orthopedic Service, Israel Zion Hospital of Brooklyn; Consulting Orthopedic Surgeon, Rockaway Beach Hospital; Attending Orthopedic Surgeon, Israel Orphan Asylum; Associate Surgeon, Lebanon Hospital, New York. Cloth. Price, $6.00. Pp. 311, with 140 illustrations. New York: Paul B. Hoeber, Inc., 1926.

The following quotation is from the author's preface: "This book is written primarily for the orthopedic surgeon, but a conscientious and painstaking effort has been made to describe the pathology, etiology, prognosis and treatment of scoliosis in such a manner that the general practitioner will find it as easily comprehensive as the inherent difficulties of the subject will permit." And this, in the main, the author has succeeded in doing. The general practitioner should have little difficulty in comprehending the author's presentation of a subject generally avoided almost instinctively by everyone except the orthopedic surgeon.

Curiously enough, it is true that books of this nature get into the hands of the general practitioner later rather than sooner—if at all. I say curiously, because the general practitioner is the medical man who most frequently functions as the "family physician," and therefore should have not only the broadest possible education (medical and general), but the largest acquaintance with at least the fundamentals of specialties, important from the point of view of prophylaxis and early diagnosis, and the keenest ability to recognize the earliest deviation from the normal. If the specialist early in his career has a somewhat limited experience, he is familiar with the literature in his line, and usually continues to keep abreast of the advances by constant contact with current literature. Rarely, however, does the patient with incipient or early pathology reach the specialist. The "family physician" has the first contact with the patient, the first and earliest opportunity to recognize beginning pathology. He is the one to whom the patient or the patient's family looks for reliable advice in the handling of an early condition when the prognosis is still favorable, and before expensive treatment becomes necessary. This condition is particularly marked in orthopedics. On the other hand, the conscientious general practitioner, distracted by many calls on his time, worried by constant responsibilities thrust upon him by his patients, turns hopefully to the various books dealing with specialties, looking for knowledge and seeking to improve his judgment in this respect. He finds large volumes, verbose with the discussion of numerous theories. He soon learns to react with a shudder to the impulse to "read up" on any subject, and more particularly orthopedic problems.

The author of the book under review, by carefully refraining from entering into lengthy theoretical discussions, and by presenting his facts in a clear, concise, easily read style, has produced a book which we gladly commend to the attention of the general practitioner, as well as to the orthopedic surgeon. He presents a simple and practical classification of the types of scoliotic deformities. Excellent printing, clear illustrations, and well-drawn diagrams help to make the book more easily read and understandable. As to the text itself—certainly facts substantiated by years of experience are of more practical value than elaborate and involved theories.

The author's classification of scoliosis from an etiological standpoint, however, is not as good as the rest of the book. It is confused and difficult to follow. For example, under the head "B. Acquired Scoliosis," there are listed the following items:

2. Paralytic (including residuals of infantile paralysis).
6. Diseases of the nervous system.
7. Affections of the spine (under this is included achondroplasia).
9. Congenital dislocation of the hips.
12. Hereditary scoliosis.

The paralytic group may well be included in Group 6. Congenital dislocation of the hips is certainly no more an acquired type than the cases due to congenital cervical ribs, which the author lists under congenital causes. A little rearrangement of this classification would eliminate what is perhaps the weakest feature of the book.

By becoming familiar with this book the general practitioner may place himself in a

position to relieve, and in some cases prevent, much misery and suffering.

H. S. Hoffman.

A Descriptive Atlas of Visceral Radiograms. By A. P. Bertwistle, M.B., Ch.B., F.R.C.S. Ed., Late Resident Surgical Officer, General Infirmary, Leeds, and E. W. Shenton, M.R.C.S., L.R.C.P., Late Senior Surgical Radiographer, Guy's Hospital, London. Cloth. Price, $12.50. Pp. 250, with 330 illustrations. St. Louis: C. V. Mosby Co., 1926.

This book, unquestionably, will prove to be a very desirable addition to the libraries of all roentgenologists, and of physicians who wish to familiarize themselves with the plates of patients they send to the roentgenologist for study. As a handy reference book and atlas it is quite valuable. It will be an incentive to the general practitioner into whose hands it falls to give his patients the benefit of roentgenological examination more frequently than is the vogue at this time, and indicate to him the more common conditions which lend themselves most readily to this form of diagnosis. Unfortunately, the price of the book will probably tend to keep it in the hands of roentgenologists almost entirely.

The material, which consists for the major part of reproductions of roentgen plates of typical pathological conditions, is admirably arranged to make it easily and quickly accessible. These reproductions are the best I have ever seen in a book of this type. Details are unusually clear. In addition, the authors have in every instance inserted in one corner of each reproduction a small diagrammatic sketch of the film, accurately locating the pathological process in its gross anatomical relations. There are 330 illustrations in this book of 250 pages. It is obvious, therefore, that the text must be rather limited in amount.

There are some inaccuracies in the text on account of this brevity, the authors having fallen into the error of making unqualified general statements. For example, on page 6 we find the statement that every clearly visible gall-bladder is pathological. I am afraid few roentgenologists would subscribe to such a delightfully simple view of the matter. Again, on page 9, in reference to pyelograms, we have the following: "Increase of content (of kidney pelvis) over 5 c.c. signifies hydronephrosis." If we must set an arbitary figure, and I am sure genito-urinary surgeons would object strenuously to doing so, a higher estimate would probably be a more reliable criterion. The statment on page 22 to the effect that a fetus may be detected by the roentgen ray about the sixth month is probably too conservative. Peterson (1922) claims that the diagnosis of pregnancy can be made with the aid of pneumoperitoneum between the sixth and the tenth week. However, I mention these points merely to call attention of the reader to the necessity of scrutinizing the text in a book of this sort.

H. S. Hoffman.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

AIME, P., and BLONDEAU, ANDRE. Roentgenography of the posterior sinuses by means of an intrabuccal film. *J. de radiol. et d'électrol.*, Par., June, 1926, x, 267–271.

The author has a special frame which he uses to carry the film into the patient's mouth; it is made of a size to fit the average mouth. The patient sits in front of a table with his chin resting on sand-bags. The tube-carrier, provided with a localizer 5 cm. in diameter is placed in contact with the vertex. The pressure of the localizer immobilizes the head. The normal rays fall on the point of intersection of a sagittal line passing through the middle of the head and a frontal plane passing through the boundary between the anterior third and the posterior two-thirds of the zygomatic arches. The plane of the base of the skull and the plane of the film are not parallel and form an angle open forward which varies somewhat in different subjects. Therefore the localizer must be inclined 10–15° toward the end of the nose. To get the picture of the anterior cells of the ethmoid the normal ray should be centered 2 to 3 cm. in front of the point of intersection described above and the localizer inclined forward less. By centering differently a total view of the sphenoid and ethmoid sinuses can be obtained.

Two series of roentgenograms are given showing the findings in the dry skull and in the living subject.

ALLEN, LEWIS G. The radiographic evaluation of the pulmonary tuberculosis lesions. *J. Kansas M. Soc.*, July, 1926, xxvi, 211–215.

The degree of precision to which a roentgenogram of the lungs may be interpreted depends entirely upon the ability of the interpreter to assess shadow values in terms of pathology. Six chief causes of technical blurring of detail in the roentgenogram are: (1) placing of the tube focus at a distance much less than 40 inches; (2) movement during exposure; (3) large size of the focal spot on the anode; (4) poor contact between the intensifying screen and the film; (5) secondary radiations produced in large patients, and (6) position of the patient.

The classification of tuberculous pulmonary lesions may be condensed to three gross types omitting many important sub-types. These are (1) miliary, (2) exudative, and (3) glandular tuberculosis, and the exact evaluation of the pathological state of the infection may be rather precisely determined roentgenographically.

ARISZ, L. Roentgenological examinations of the stomach after resection. *Acta radiol.*, March 15, 1926, v, 196–206.

A report is given of the roentgenological findings in the stomach after resection of the pylorus and lesser curvature by the Shoemaker technique. In patients who have recovered satisfactorily from the operation, the roentgen examination shows that the form and position of the stomach, as well as its function are fairly satisfactory, provided the operation has been skillfully performed. The muscular wall has to some extent been damaged, as it appears to have lost the property of discharging the contents completely. The small retention, however, is not regarded as a serious factor in the formation of a new ulcer since the lesser curvature has been removed.

ARISZ, L. Observations on the function of the stomach after gastroenterostomy and similar operations. *Acta radiol.*, June 30, 1926, v, 236–249.

An analysis was made of the conditions found in enterostomized stomachs. The operation diminishes the mobility, but does not change the possibility of peristaltic movement nor the maintenance of the pyloric mechanism. Both these actions, however, depend upon the extent of the discharge through the anastomosis and on the posture of the patient during the examination.

In enterostomized stomachs, ulcers continue to produce spastic deformities of the gastric wall, thus hindering peristaltic movement. The enterostomized stomach with an ulcer, therefore, is different from the enterostomized stomach without an ulcer.

The obvious result of the operation is the discharge through the anastomosis; and an examination of the extent to which ulcers have changed when the second outlet was established discloses nothing very definite. Hence the benefit usually obtained by patients cannot be well explained. A few illustrative cases are cited.

ARMANI, LODOVICO. A new method of roentgen study of the appendix. *Radiol. med.*, August, 1926, xiii, 534–540.

Ever since Lierz first published the statement

that he had seen the appendix on roentgen examination there has been an active discussion as to whether the normal appendix is visible or not, some authors asserting that it is and others, equally authoritative, saying that visibility is a sign of disease.

Armani devised a special method for examining the appendix. He dissolves the opaque medium in dolomina, a water containing magnesium chlorid. The same results could probably be obtained with any liquid containing magnesium chlorid. He examined 43 subjects in this way. Seven of them had chronic appendicitis and the appendix was not filled with contrast medium in any of these. Subtracting these cases 25, out of the remaining 36 were filled, or a percentage of 69.45. But among these 36 cases there were 9 in which there were causes, such as colitis or adhesions, which probably prevented the filling of the intestine, leaving 25 out of 27 normal appendices which filled and were rendered visible in the roentgenogram, or a percentage of 92.23. He has found that in chronic appendicitis the appendix does not fill, which seems natural as it may be filled with feces which prevents the entrance of the contrast fluid, or it may be atresic or enlarged or in a state of inflammatory irritation which causes spasm or swelling of the inner wall. He therefore concludes that the normal appendix is visible in 70 to 90 per cent of cases and that the appendix with chronic appendicitis is not visible. If later study of a larger material should confirm these findings this will be a valuable aid in diagnosing chronic appendicitis, and even if it is found that the appendix with chronic appendicitis fills also, it will be possible to study it by other signs, such as irregularity of the outline, pain, etc., which always accompany this disease.

Béclère, Henri, and Porcher, Pierre. Roentgenology of the duodenum in conditions other than ulcer. *J. de radiol. et d'électrol., Par.*, July, 1926, x, 300–305.

There are many variations of even the normal bulb in the frontal position but this is not true of the profile. The normal bulb with a normal stomach is shown in strict profile exactly behind the stomach. If the bulb is in front of the body of the stomach it generally indicates periduodenitis with adhesions to the anterior wall. But if it is back of the stomach it has contracted adhesions with the gall-bladder or the liver or with postoperative cicatricial tissue. These changes in position of the bulb may also be caused by pressure of neighboring organs. Pressure by the gall-bladder gives a typical cup-shaped depression of the greater curvature of the bulb, generally accompanied by retroposition of the 2d portion, but if the gall-bladder lies very far forward there may be a very clear depression without any change in the position of the 2d portion. A diagnosis of the cause of the gall-bladder imprint is greatly facilitated by cholecystography. The bulb may also be compressed by the lower border of the liver, which presses the greater curvature into almost a straight line, or the right angle of the colon which is often drawn to the right in cholecystitis may make an imprint on the bulb of the duodenum. The diagnosis can be made from the spot of gas immediately adjacent to the duodenum. Compression by the kidneys is rare and when it exists it is always accompanied by clinical kidney symptoms. Certain cysts of the mesentery, hydatid cyst of the liver and tumor of the head of the pancreas may also compress the bulb.

There is sometimes an arrest of the barium at the boundary between the 2d and 3d portions, generally caused by linear compression by the mesenteric vessels which pass obliquely in front of the angle between the 2d and 3d portions. This picture is very characteristic; the whole duodenum is dilated, especially the 2d portion, peristalsis is generally increased and there is always antiperistalsis. This pressure decreases on dorsal decubitus and stops immediately in the genupectoral position. New growths of the head of the pancreas or of the mesenteric glands may also cause arrest at the angle between the 2d and 3d portions. Obstructions are sometimes found also in the ascending part of the 4th portion and at the duodenojejunal angle. The roentgen picture is the same: slowing of the passage of the duodenum, hyperperistalsis and antiperistalsis, "mixing" movement and temporary dilatation above the obstacle.

The authors emphasize the importance of using the selector to determine the best moment for taking a plate, rather than taking an indefinite number in series. If roentgenograms are taken in series without roentgenoscopic control a large number may be taken, for instance, without showing the enormous dilatation of the second portion due to compression by the mesenteric vessels; for this pilatation is very temporary and disappears as soon as hyperperistalsis has overcome the obstacle, and this may occur in the interval between the taking of two plates.

One of the most frequent deformities of the duodenum seen is that due to periduodenitis. The first and best sign of it is an irregular and fringed appearance of the outlines in different stages of filling of the bulb, particularly at the stage of maximum filling. There is also anteposition of the bulb in profile. Pericholecystitis gives similar pictures but most often on the face of the bulb in direct contact with the

diseased gall-bladder. Pericholecystitis and periduodenitis are often associated, but in pericholecystitis alone the best sign, aside from irregularity of contour, is retroposition of the bulb in profile. The duodenum is generally fixed in position after cholecystectomy.

Belfield, W. T., and Rolnick, H. C. Vesiculography by means of iodized oils, *J. Urol.*, July, 1926, xvi, 73–84.

Recently the authors have used for roentgenography and therapy of the seminal ducts various iodine compounds dissolved in oil and injected through vasotomy, usually bilateral. The roentgenograms were made immediately after injection. These pictures reveal certain features of the ducts which have never been described in the living or dead.

Eleven roentgenograms are presented showing the iodized oil in the ampulla, vesicle, and connected structures.

Berry, John M. A theory as to the cause of Perthes' disease based on roentgenologic findings. *J. Bone & Joint Surg.*, April, 1926, viii, 333–347.

The etiological speculations as to the cause of Perthes' disease have narrowed down to three: (1) the infective theory; (2) the traumatic theory, and (3) the congenital theory. The difficulty, however, is that no one of these theories seems to explain all cases. A discussion is presented of 13 cases as to their bearing on the etiology of this disease.

Embryological considerations suggest that a partial arrest of growth of the limb at the reptilian stage of development can result in an imperfectly formed shallow acetabulum and a small malformed head of the femur; and when rotation of the limb takes place, in order to make erect posture possible, a dislocation of the head of the femur would be apt to occur. This theory offers an explanation of congenital dislocation of the hip. When a dislocated hip of this type is reduced the trauma may affect the circulation and be sufficient to cause the already poor quality of epiphyseal tissue to break down, bringing about the changes of Perthes' disease. Perthes' disease by itself, without congenital dislocation, would simply be a poor quality of hip joint which breaks down under trauma.

The theory accounts for the various forms of Perthes' disease and related conditions such as osteochondritis of the spine, tarsal scaphoiditis, osteochondritis of the second and third metatarsals and Schlatter's disease.

Breuer, Roland G. The radiographic diagnosis of early pulmonary tuberculosis. *J. Kansas M. Soc.*, March, 1926, xxvi, 75–82.

When a case of suspected tuberculosis is referred to the roentgenologist, the latter should attempt to obtain a background for his roentgenological diagnosis by an examination of the whole patient, by eliciting the history and symptoms, and by giving the chest a cursory examination. Experience has shown that it is high time to cease to regard the practice of medicine as a sort of standardized factory in which each artisan has one and only one thing to do which he is supposed to perform with machine-like fidelity.

This demands a reasonably thorough understanding on the part of the roentgenologist of the pathology of pulmonary tuberculosis, the course of the disease and the signs and symptoms of incipient pulmonary tuberculosis in addition to the roentgenographic signs of the active condition. These various items are briefly outlined.

Campione, Giacomo. Roentgen appearance of metastatic tumors of the lung. *Arch. di radiol.*, Mar.–June, 1926, ii, 246–249.

Several characteristic cases are described. The first was in a man aged fifty-eight with clinical signs of tumor of the head of the pancreas. A few days before death a round shadow appeared above the diaphragm which autopsy showed to be a solitary metastatic nodule. The second case was in a woman of fifty with clinical and roentgen signs of tumor of the stomach. There were few râles at the base of the lung, moderate dyspnea and cyanosis; diffuse marbling of both lung fields with hazy spots, especially numerous at the right base. Case III was in a man of sixty-two with clinical signs of tumor of the biliary tract; decreased breath sounds at the bases, a few râles and moderate dyspnea; roentgen examination showed hazy nodules of different sizes in both lung fields. Case IV was in a woman of fifty-six. She had tumor of the left breast which had been operated upon, had recurred and ulcerated. Enlarged hilus glands on both sides; diffuse nodules, especially at the left base. Case V was in a man of fifty-eight with clinical signs of tumor of the head of the pancreas. Had formerly been treated for tuberculous lesions of the apices. There was haziness of the apices, most marked on the right, and on this side there were stripes running from the apex to the hilus interspersed with nodules. Later examinations showed rapid extension of the process to both lung fields. Autopsy showed diffuse lung metastases with peribronchitis. Case VI was in a man of twenty-five who had recently had a retained testicle removed; it had grown to the size of an orange. Roentgen

examination showed both lung fields very clear from vicarious emphysema; in both fields there were round shadows at different depths, some of them superimposed on each other. Some of them were perfectly round and looked like echinococcus cysts. Béclère has called attention to the fact that sarcoma of the lung sometimes looks like echinococcus cyst in the roentgen picture. Another characteristic feature of these lung metastases is that they often present practically no symptoms.

Cleveland, Mather. Situs inversus viscerum. *Arch. Surg.*, September, 1926, xiii, 343–368.

A report is given of a case discovered in the dissecting room. In subsequently tracing the case, it was found that the condition had been recognized and studied by the clinicians in a hospital in New York so that a complete history was obtainable. The condition found was a complete transposition with a variation in the genito-urinary tract, a fused kidney situated entirely in the left umbilical and lumbar regions. The two components of this double organ were readily recognized and the ureters pursued a relatively normal course after passing over the pelvic brim.

Roentgenoscopic examination showed the position of the heart to be entirely transposed, and later examination of the gastrointestinal tract showed complete transposition of the viscera. The stomach was on the right side of the abdomen and there was transposition of the gastric and gastro-colonic mass in the lower quadrant. The various anatomical features and measurements are described in detail.

The author also presents a bibliography of the cases of situs inversus reported from 1912 to 1925.

Comelli, Umberto. Diagnostic use of pneumoperitoneum. *Radiol. med.*, June, 1926, xiii, 428–435.

The introduction of gas into the peritoneum is of great value in the diagnosis of many abdominal diseases by isolating the organs and bringing out their size and form more clearly. Oxygen is the gas used and the process is very simple. A long needle is introduced through the abdominal wall at the boundary between the middle and lower thirds of the line from the umbilicus to the pubis. When the operator feels the characteristic sensation which shows that the needle is in the peritoneal cavity the insufflation is performed slowly, keeping the pressure low as shown by the manometer on the oxygen tank.

The author describes 5 cases, in one of which he was able in this way to make a diagnosis of cirrhosis of the liver; in one of splenomegaly with perisplenitis, confirmed by autopsy; in one of microgastria with very thick stomach walls, probably gastric cirrhosis; in one of syphilis of the liver, and in the last of superficial lateral adhesions of the liver with the wall of the thorax.

He has never had any serious accidents. If the needle is not introduced deeply enough and the gas is insufflated into the tissues of the abdominal wall the patient will feel pain and the needle can be withdrawn; insufflation into the peritoneal cavity is painless. In his case in which there were adhesions the needle passed into the intestine and roentgenoscopy showed the whole colon distended with gas; it was passed *per rectum* in a little while and there were no injurious consequences, but pneumoperitoneum is contraindicated in cases where there are adhesions.

It is not necessary to know the amount of gas introduced into the abdominal cavity; as it is only necessary to introduce enough to render the hypochondriac viscera visible without using enough to disturb the patient, he thinks that the following rules will serve as a guide as to the amount to be introduced: (1) the gas should be introduced slowly; (2) the subjective sensations of the patient should be noted, as well as the objective tension of the abdominal walls; (3) the patient should be under roentgenoscopic observation so as to watch the depth to which the needle is introduced and during the insufflation of the gas so that the latter may be stopped as soon as the diaphragm is lifted sufficiently from the underlying viscera, that is, as soon as the latter become visible.

Cross, W. W. The fluoroscope as an aid to making pyelograms. *J. Urol.*, July, 1926, xvi, 37–42.

Sufficient emphasis does not appear to have been given to the importance of roentgenoscopy in pyelographic examinations. The procedure will eliminate many uncertainties and will add a factor of safety. The method of injecting the kidney with an opaque solution using as a guide the expression of discomfort on the part of the patient is not reliable in every instance and is fraught with some danger.

In the normal condition the first cubic centimeter of fluid injected into the kidney pelvis excites a sudden impulse resulting in contractions, and the fluid is observed to move rapidly. The filling is sudden, so are the waves that develop as the fluid descends in the lumen of the ureter.

There are conditions in the early changes of

the kidney that are not possible of demonstration unless the cavity consisting of the calyces and kidney pelvis is kept filled by the opaque solution at the time the plate is exposed. Working blindly, one is frequently at a loss to know why the kidney pelvis does not fill in a particular case. Roentgenoscopy under these conditions is of decided help.

When an individual has had an infection of the upper urinary tract for a long time, from five to twenty years, the changes in the wall of the pelvis and ureter are such that the peristaltic wave developed by injecting fluid into the kidney pelvis is decidedly changed. The contraction is not as quickly induced and when observed appears to be stronger. Pain, however, is not as easily induced.

When unsuccessful in passing the catheter to the kidney pelvis, to blindly inject the ureter above the obstruction would be difficult or uncertain. Under roentgenoscopic observation this is comparatively easy.

Pain, the result of injecting the kidney pelvis, is influenced by several factors. The position of the catheter has a marked effect. If the catheter is in a normal or nearly normal calyx a small amount of fluid will cause severe pain which is modified at once if the catheter is drawn down to the kidney pelvis. When the catheter is below the kidney pelvis in the ureter more pain will be induced than if the catheter is higher. As a rule, the pain is in inverse proportion to the diseased condition of the kidney. Sodium bromide injections appear to be more painful than sodium iodide solutions now in use.

D'Amato, Giuseppe. Normal and pathological pictures of the gall-bladder. *Radiol. med.*, September, 1926, xiii, 630–644.

The author describes in detail the technique of intravenous injection of sodium tetraiodophenolphthalein by means of which he examined a large number of normal and pathological gall-bladders. The examination is absolutely harmless even if repeated many times. The normal gall-bladder and many pathological ones are clearly visible in the roentgenogram after this injection. The causes which render the gall-bladder invisible, aside from faulty technique, are: (1) serious injury of the secreting function of the liver. Generally this does not give an absolutely negative result, but there is more or less delay in the appearance of the shadow, depending on the severity of the disease, and it is paler than usual. Decreased function of the liver is seen in all degenerative and atrophic diseases of that organ and also in retrograde stasis from occlusion of the bile ducts, as in cancer of Vater's papilla, the head of the pancreas, the common duct, etc. (2) catarrhal processes of the bile ducts with swelling of the mucous membrane and occlusion of the lumen of the duct. The findings are frequently negative in acute infective icterus, but if the examination is repeated in a few weeks, after the acute inflammation has subsided, the gall-bladder will be visible again. (3) Occlusion of the hepatic and cystic ducts from various causes, such as inflammation, stones, or tumors. (4) Advanced sclerosis of the gall-bladder with total or partial obliteration of its lumen. (5) Pressure on the hepatic and cystic ducts from outside by tumors of surrounding organs. (6) Spasm of the sphincter of the gall-bladder from the presence of stones.

In such cases medical treatment should be given for some weeks and the examination repeated; if it is still negative and degenerative processes of the liver can be excluded by clinical examination operation is indicated.

The examination also shows the relations of the gall-bladder to the digestive tract. This is influenced to a great degree by whether or not the colon is distended. Illustrations are given showing the position of the gall-bladder with reference to the stomach and intestine under these conditions and when there are adhesions. A section of the article is also devoted to the findings in gallstones. In general gallstones are visible as clear spots on the dark background of the opaque gall-bladder.

D'Amato, Giuseppe. Roentgen appearance of metastatic tumors of the lung. *Radiol. med.*, May, 1926, xiii, 370–380.

The morphological character of a lung metastasis cannot be diagnosed by roentgen examination but there are four forms of pulmonary metastasis that can be distinguished; (1) the miliary form; (2) the lymphangitic form; (3) the nodular form, and (4) the massive or pseudopneumonic form.

The first form is rather rare and shows an invasion of small opaque nodules from the size of a millet-seed to that of a grain of wheat, distributed all over the lung fields, but not uniformly. This form of metastasis is particularly frequent in chorioepithelioma but is also found in melanosarcoma, Boeck's sarcoid and carcinoma. Differential diagnosis from miliary tuberculosis is rather difficult, but in contrast with miliary tubercles the nodules are somewhat larger, not so uniformly distributed and are more numerous and dense in the lower part of the lung fields.

The second or lymphangitic form is frequent in primary carcinoma of the breast and stomach. It shows delicate stripes irradiating from

the hilus into the lung tissue and forming a large network. The stripes are not like those of the normal lung outline but are tortuous and irregular and present little nodules along their course, giving the appearance of a rosary. This striation is found for the most part in the lower two-thirds of the lung fields; the mediastinal shadow is enlarged bilaterally, and its outlines are clear but irregular, almost dentate. In the latero-lateral roentgenogram the interlobar septa are visible and they too are infiltrated. Differential diagnosis from the acino-nodular and cirrhotic forms of tuberculosis is not especially difficult; while the latter occupies chiefly the upper part of the lung fields, carcinomatous lymphangitis chiefly invades the lower segments. It can be distinguished from cirrhotic tuberculosis by the lack of signs of sclerosis—displacement of the trachea and mediastinum, decreased size of the corresponding lung field, etc.

The nodular form is the most frequent one and is found in both epithelial and connective tissue metastases; it presents one or more rounded or oval shadows from the size of a lentil to that of a large apple, distributed irregularly. The shadows are quite homogeneous and their outlines well defined but irregular. In epithelial metastases there is also enlargement of the mediastinal shadow due to enlargement of the tracheobronchial and hilic lymph glands with increase of the striation running from the hilus into the lung field. There is always infiltration of the interlobar fissures which are visible as delicate lines. If the case is observed early there may be only one small shadow; frequently in epithelioma of the breast there is one small lung nodule on the same side. If the metastases are multiple from the beginning there is a diffusion of small round nodules chiefly in the lower two-thirds of the lung. The nodules in general are a little larger than those of nodular tuberculosis and they are not so opaque as calcified tuberculous nodules. The more advanced the case and the larger the nodules, the more difficult is the differential diagnosis. With a number of large nodules from the size of a cherry to that of an apple, round and with clearly defined outlines, it is rather hard to differentiate from echinococcus cyst. A similar form of metastasis is quite frequent in hypernephroma and is characterized by extraordinary clearness and regularity of outline.

The nodular form passes gradually into the massive form which is quite frequent in sarcoma; in this form differential diagnosis from the ordinary infiltrative diseases of the lung is very difficult, and even impossible without the aid of the history and clinical examination.

Denman, Ira O. Status of radiotherapy in ophthalmology and otolaryngology. *J. Ophth., Otol. & Laryngol.*, June, 1926, xxx, 208–216.

For the ophthalmologist the powerfully active water-cooled ultraviolet radiation finds several valued uses in the treatment of the various ocular and periocular tissues which become diseased. Various forms of blepharitis such as blepharitis ciliaris, marginalis and ulcerosa, yield quickly to ultraviolet irradiation. Congenital tuberculosis yields definitely to ultraviolet treatment; so do eczematous keratoconjunctivitis and gonorrheal ophthalmias. Photosensitization with mercurochrome combined with ultraviolet irradiation is very effective in infections.

In cases of impaired heart due to obstructive pathology incident to hypertrophied lymphadenoid tissue involving especially the fossa of Rosemueller, the power of roentgen rays to dissolve the lymphadenoid tissue gives great relief. Infection of any portion of the lymphadenoid pavement of the nasopharynx can take place when the tonsils have already been removed. This wide distribution of general infection cannot be done away with adequately excepting through the use of roentgen rays. The condition often called chronic catarrh in the nasopharynx can also be efficiently treated with mild doses of roentgen rays.

There are quite a number of instances where for one reason or another surgery is probably not the best expedient and where roentgen treatment may be entirely adequate. After the roentgen rays have produced shrinkage of the tonsils, ultraviolet radiation may be employed to exert a bactericidal effect and induce hyperemia.

It is frequently observed that in toxic goiter, the lymphatics in the region of the thyroid and the upper respiratory tract show evidences of deviation from the normal. It is suggested that ultraviolet irradiation be employed as an accessory to the usual treatment of toxic goiter and in addition roentgen irradiation to the chain of lymphatics extending down to the thyroid. These should be most helpful adjuvants to the usual roentgen and medicinal treatment, the efficacy of which is already recognized.

Drueck, Charles J. Operability of cancer of the rectum. *Illinois M. J.*, August, 1926, l, 155–157.

Rectal carcinoma remains localized for long and this fact would make its radical removal a very hopeful undertaking if the growth can be discovered early. A thorough roentgen examination is indispensable. Such an examination made by an expert presents very definitely and distinctly the filling defects by a barium mix-

ture. The examination should be roentgenoscopic, and films should also be taken in order to determine accurately the condition and location of the lesion. By such a carefully interpreted roentgen examination, very few cancers of the pelvic bowel can escape diagnosis, while at the same time undue importance will not be given trivial deviations from the normal.

The pelvic bowel may be examined after a barium meal by mouth or with the aid of an opaque enema. The clyster is the more frequently used and in the study of obstruction of the bowel the clinician will gain valuable evidence while watching the inflowing enema. The patient lies on his back on the screen table and the opaque mixture is allowed to fill the rectal ampulla. The sigmoid flexure and the rest of the colon fill irregularly; and at this time palpatory manipulation is employed.

There are wide variations in what must be considered pictures of the normal terminal gut, *i.e.*, where junction is normal and there is no visible lesion in the rectum. The descending colon usually varies somewhat at the sigmoid flexure and expands again at the ampulla, then tapers towards the anus. The most important sign on the roentgenogram of the pelvic bowel is the filling in of defects in the contour of the bowel. This change from the normal outline may be due to spasm of the colon, to feces, intestinal gas, adhesions or extrinsic pressure on the intestine or tumor growth. In cancer, this irregularity may be sharply outlined or definitely shaded.

In the colon, obstruction other than cancerous is very rare. The filling defect shows the proximal limits of the disease. This deformity of the outline of the intestine may show a concentric narrowing of the lumen or it may be limited to one side. After a tumor has been located, it has to be differentiated from diverticulitis, tuberculosis, actinomycosis, syphilis, and benign tumors within the colon. Spastic contractures of the sigmoid colon show as small irregular haustra. Five cases are briefly cited.

Doub, Howard P., and Davidson, Edward C. Roentgen-ray examination of the joints of hemophilics. *Radiology*, March, 1926, vi, 217–227.

A brief review is presented of some of the literature on hemophilic arthritis with reference to the roentgen-ray changes. Case reports are given of 7 patients observed by the authors. Two of these cases are classed as early because no bone destruction was noted. Most of the observations noted in the early cases concern the soft tissues, with the exception of the lipping which is seen after repeated attacks. Five of the cases might be classed as advanced in that the lesion had progressed to the destructive stage.

Two groups of roentgen-ray signs must be considered: (1) the signs seen in the early cases or in those exhibiting no destructive change, and (2) the signs seen in the advanced cases which exhibit destructive changes. In the first group the findings include: (1) effusion of blood into the joint which may or may not show calcification; (2) thickening of the joint capsule; (3) lipping similar to that found in hypertrophic arthritis. These changes may or may not be diagnostic, but the presence of a calcified hematoma in a case presenting joint symptoms is strongly suggestive of this condition. This type of case may suffer repeated attacks of hemarthrosis without the signs progressing beyond this point. The findings in the group of advanced cases are much more distinctive: (1) general or localized cartilaginous destruction; (2) bone destruction of several varieties; (*a*) punched out areas in the epiphysis, with an intact articular surface due to hemorrhage into the epiphysis; (*b*) destruction of the articular surface often with localized rounded areas of destruction extending into the epiphysis; (3) blood clot in the synovial cavity which may become organized with some calcification. The above signs are characteristic of hemophilic arthritis and when the typical punched out areas of destruction are seen in conjunction with the organized blood clot the diagnosis can be made without other clinical data. In the differential diagnosis tuberculosis is the principal joint lesion to be considered. The main differences between this and tuberculosis are the clearness of outline of the articular surfaces, the peculiar type of punched out areas already mentioned, and fluid in the joint which is likely to undergo organization with deposition of calcium.

Eastmond, Charles. Gastro-intestinal infection; its roentgen manifestations. *Brit. J. Radiol.*, March, 1926, xxxi, 93–104.

For years abnormal appearances of the pyloric end of the stomach of the type that is neither ulcer nor malignancy have been observed both roentgenoscopically and on the film. Some roentgenologists regard this as a spasm, while some have considered it a prepyloric ulcer. The author regards it as an erosive condition which should be called ulcerative gastritis.

The second type of gastric change is one in which there are no localized defects in the marginal fillings of the stomach, but the pyloric extremity for a distance of 2 or 3 inches is smooth, contracted and shows an alteration

in the character of the peristaltic waves. This condition is frequently spoken of as "stiffening," and is often more than chronic round cell infiltration and fibrosis.

Non-ulcerative deformities of the duodenum have been considered to be the result of adhesions secondary to pericholecystitis. While the gall-bladder is usually coincidently involved in the infectious process, the author believes that some of the changes are not the result of extrinsic interference, but are due rather to changes within the duodenal wall itself. When adhesions occur they arise from the serosa of the duodenum rather than around the gall bladder wall to involve the duodenum secondarily. A great variety of abnormal conditions of the terminal ileum has been described namely, the kink, the veil, abnormalities of the meso-appendix, and various other external conditions, influencing the part, but the author believes that the question of intrinsic ileitis has been grossly overlooked. The process takes the form of a rigidity, a lack of elasticity and an alteration of the rate at which the barium passes through.

Changes of infiltrative or sclerotic type may involve a considerable portion of the inner side of the cecum so as to include the ileocecal valve. Under such circumstances ileocecal incompetency is a usual accompaniment. Chronic sclerotic changes in the colon have long been recognized as the result of chronic infection of the same type. Roentgenologically the lack of elasticity or irregular contraction is very evident. The most common site of the lesion is in the sigmoid, probably because that is the portion of the intestine in which there is fecal retention with consequent increased opportunity for bacterial invasion. All of these lesions of the gastrointestinal tract mentioned, which represent pathological changes subsequent to infection are clearly and definitely demonstrable by roentgen examination.

Eberson, Frederick. Studies in tuberculosis. VI. Latent tuberculosis in childhood, with reference to tuberculin reactions, clinical findings and x-ray studies. *Am. Rev. Tuberc.*, February, 1926, xiii, 124–148.

One hundred and forty-five cases of juvenile tuberculosis have been studied with regard to history, age grouping, symptomatology, physical and roentgen findings and tuberculin reactions. These cases were observed at the Glen Lake Sanatorium, Minneapolis, and in the Chest Clinic at the University of California. Regardless of the degree of exposure to infection, 72 per cent of the cases were in the age group one to nine years.

It is not possible to make unequivocal statements regarding a symptom-group which may be called pathognomonic of tuberculosis. The evaluation of single or grouped symptoms became relatively accurate when these were interpreted in relation to the roentgen-ray and tuberculin findings. Physical examination yielded information of only slight value except in patients frankly tuberculous; d'Espine's sign was not found to be diagnostic and was not correlated with adenopathic changes.

The roentgen-ray examinations furnished probably the most important and significant data in this investigation when used in conjunction with other observations. It would appear that pulmonary foci are frequently overlooked. There is evidence to show that indisputable hilum adenopathy associated with a pulmonary ocus and a positive or suggestive clinical history, even when symptoms are negligible or absent, warrants a diagnosis of tuberculosis. Pulmonary foci were found in 46.5 per cent of the patients in this study, and of these 71.6 per cent showed calcification of the focus or of the adjacent intrapulmonary lymph nodes. Parenchymal infiltration occurred at times in conjunction with such changes or as a supervening process which came to notice after subsequent roentgen-ray studies. Peribronchial tuberculosis of the nature of definite pathological changes or adjacent to bronchial ramifications was demonstrated roentgenographically in 5 per cent of the cases. The changes ranged from simple thickening and slight beading of the bronchial markings, particularly in the apices, to a definite peribronchial infiltration at the apex or base, or both. At times, small irregular, calcified areas adjacent to the bronchial terminations augmented the usual picture. Mediastinal adenopathy of clinical significance could be shown readily with the aid of lateral roentgenograms. These were found to be indubitably valuable in recognizing lymph-node changes which remained undiscovered otherwise.

Hilum tuberculosis was characterized chiefly by considerable calcification of enlarged lymph nodes with an extension of calcified nodules toward the periphery of the lung. In some instances there was localized fibrosis and calcification which ranged outward as an extension of the tuberculous process to the parenchyma. In 10 per cent of the cases the pathological changes were hardly distinguishable from old fibrotic lesions which are found in adults.

There was a complete correlation between positive tuberculin tests and clinical and roentgen findings which warranted the diagnosis of latent or active tuberculosis.

EDITORIAL. Cholecystography. *Lancet*, July 3, 1926, ii, 25–26.

One of the finest examples of fruitful results proceeding from academic medical research is the evolution of tests for the function of the kidneys and liver which was led up to by the investigation of the pharmacology of phenolphthalein compounds. The sulphone derivative of phenolphthalein is excreted almost solely by the kidneys while the halogen compounds are excreted partly by the kidney but to a greater extent by the liver. Considering the fact that Graham's preliminary report was published only in 1924, a very considerable amount of knowledge has been collected on the subject of cholecystography, and the method although not yet standardized has become definitely established in clinical medicine.

There is no doubt that the intravenous method of administration of the dye gives better shadows and is on the whole more reliable than the oral method, but as regards safety for the patient the method of oral administration is less hazardous. The dose which can be administered by mouth is no greater than that by the veins, for if it is increased, vomiting is produced and the test is spoiled. There appear to be but few failures when the cholecystographic test is properly carried out. Even allowing for the enthusiasm for a new and ingenious procedure, the results of cholecystography reported from all quarters show such a degree of reliability that the method is certain to obtain a permanent place in diagnosis.

EISENSTAEDT, J. S. Primary congenital megalo-ureters. *Arch. Surg.*, July, 1926, xiii, 64–74.

Primary congenital megalo-ureter is a condition presenting enormous bilateral caliber of the ureter in cases in which there is no demonstrable obstruction to the urinary outflow, as determined at necropsy or by complete examination during life. The condition has been observed in the fetus, in the newborn and in early life.

The chief characteristics of the ureterogram of primary congenital megalo-ureter which differentiate it from the acquired type and the congenital type due to obstructive processes are: (1) the bladder is enlarged and shows increased capacity; (2) there is no evidence of obstruction in any part of the tract due to any mechanical condition, such as stone, valve or stricture of the ureter or urethra; (3) the filling of the ureteral trees is bilateral, complete and symmetrical, and practically equal on both sides, and reflux is complete without any pressure other than that of the filled bladder. There is no demonstrable demarcation between the filling fluid in the bladder and that in the ureters.

The author reports 2 cases occurring in girls, aged five and seven and a half years, and in these cases the cysto-ureterograms and cystoscopic findings were characteristic.

The mechanism underlying the development of this condition may be explained by embryologic conditions, probably a deficiency in the development of the musculature of the ureters.

EISENDRATH, DANIEL N. The diagnosis and treatment of bladder tumors. *Illinois M. J.*, September, 1926, I, 205–210.

For practical purposes it is important to remember that about 90 per cent of all bladder tumors belong to the epithelial type. The remaining 10 per cent include benign neoplasms like fibromyoma, angioma, adenoma, and more malignant ones such as sarcoma, sarcocarcinoma, etc. About 40 to 50 per cent of the epithelial bladder tumors are simple papillomas. Bladder tumors present one or a combination of the following predominant symptoms: (1) hematuria; (2) symptoms like those of an acute or chronic cystitis; and (3) symptoms of bladder neck obstruction.

For clinical purposes of therapy, cases may be divided into: (1) those showing prospect of cure; (2) those in which cure is questionable, and (3) those in which it is hopeless, and where therapy can be only palliative. The tumors in Group 1 include the benign papilloma whether pedunculated or sessile. This can be handled effectively by fulguration with or without radon implants. About 35 per cent will recur after endovesical treatment, but even these can usually be cured by further treatment. In other cases, surgical diathermy through a suprapubic cystotomy incision is found effective. Diathermy gives promise of far more permanent cures in both benign and malignant papillomas than does either radium or resection.

The cases in the second group include those of recurrent papilloma in which fulguration or radium treatment is of no avail, and also cases of papillomas which appear to be malignant from the outset. Clinicians are still groping in the dark as regards the treatment of such cases. Some prefer radium alone, others believe in resection of the tumor, while still others employ a combination of these two methods in conjunction with deep roentgen therapy and diathermy. The statistics from the various clinics are not very encouraging. The author has found that surgical diathermy applied through a suprapubic incision has thus far given the most satisfactory results in

medium and large benign, as well as malignant papillomas.

The therapeutic means which can give relief to the incurable cases are deep roentgen therapy, endo- or transvesical insertion of radium, ureterostomy or nephrostomy and reimplantation of the ureters into the rectum.

Farr, Charles E. Dislocation of the carpal semilunar bone. *Ann. Surg.*, July, 1926, lxxxiv, 112–115.

During the past seven years about 20 cases of dislocation of the carpal semilunar have been observed, 12 of which were treated by closed reduction or excision of the bone. One case was seen on the day of accident and the dislocation was reduced with great ease and gave an excellent result. Late reduction or excision may give good but not perfect function. About 10 per cent of stiffness and weakness of the wrist will usually occur in late cases.

Without the use of roentgenograms only a good guess may be made, but the presence of a painful, weak, swollen wrist with a special swelling on the anterior surface and rather marked limitation in flexion with local tenderness are quite suggestive of the lesion. In the present series the correct diagnosis was made on several occasions before confirmation by the roentgenogram.

It seems reasonable to believe that most of these dislocations really start as dislocations of the os magnum backward. As the force is continued the os magnum drives the semilunar from its pocket in the carpus and itself resumes a more normal position in the wrist. This was noted repeatedly on partially successful reductions of a dislocated semilunar. The bone reaches nearly a normal position in the carpus except for its relations with the os magnum. Three cases are briefly cited.

Fraser, R. H. Iodized oil (lipiodol) in otolaryngologic diagnosis—opaque injection study of thirty-five maxillary sinuses. *J. Mich. M. Soc.*, June, 1926, xxv, 270–274.

The maxillary sinus may be readily filled for roentgenographic study by opaque injection following the diagnostic irrigation. Experience shows that in cases where diagnosis is obscure the opaque injection supplements the data obtained on the one hand from the diagnostic irrigation and on the other from the ordinary roentgenogram. Iodized oil, preferably diluted, is safe and is without the disagreeable qualities of argyrol, but it may be replaced by other media developed for certain cases. The filling should be complete and loss of oil should be prevented.

In over a year the author has injected 50 upper respiratory spaces. Interesting observations were made upon sphenoidal and frontal sinuses, and very helpful findings were obtained in cases of mastoid fistulae. Thirty-five cases were of the maxillary sinus in which the best results were secured.

It is of importance to keep the head of the patient constantly in the lateral position until all films are made. This means that during their exposure, the posteroanterior films are held in a vertical plane by a special support. It was found after various experiments that the use of a one in three dilution of the iodized oil in petrolatum differentiated thin layers from masses, and in the stereoscope permitted the sinus to be seen in three dimensions. Except when there are abnormalities in the region of the os maxillaris, the sinus frees itself of oil spontaneously in a few minutes. The use of petrolatum with the oil may delay the emptying and necessitate an irrigation adapted to its removal.

Friedländer, Conrad. Armored heart. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, January, 1926, xxxiv, 145–152.

A report is given of a case of extensive calcification of the heart which came to autopsy and permitted a careful histological examination of the heart substance. The extreme degree of calcification found in this case is very unusual. The calcification begins usually at the coronary sulcus and first involves the right heart and then passes over to the left. In some cases the apex may become inclosed in the shell. The conus pulmonalis as the place of greatest activity in the heart may remain free from calcification. The course of the disease is very chronic and in the case described must have been progressing at least for twenty years. The diagnosis of the condition during life is possible only by means of roentgen rays. Surgical therapy at least in cases of extensive calcification seems to offer small prospects of success.

In the present case the heart was inclosed in a calcareous cup; the ventricles, including the apex and the lower portion of the right auricle were completely surrounded. At the coronary sulcus the lime deposit was especially thick, 1.5 to 2 cm. Over the right ventricle there was a thick plate 9 × 7 cm. of a thickness up to 1.5 cm. There was a similar plate over the left ventricle about 9 cm. in diameter and up to 1.5 cm. thick. The plates were firmly connected to each other by spicules of lime extending over the whole heart. The left auricle was free from lime while the right was covered with calcium from the coronary sulcus on, the lime being especially thick anteriorly. It was impossible to move the various lime spicules toward each

other. The thickness of the calcification was greatest at the coronary sulcus at both ventricles and at the apex. The conus pulmonalis was the only area entirely free from lime and it was surrounded to the right and left by the ventricular coats.

FRIEDRICH, H. The weakly concentrating gall-bladder in relation to cholecystography. *Deutsche Ztschr. f. Chir.*, 1926, cxcviii, 1–10.

In 27 out of 100 cases, it was not possible to obtain a gall-bladder shadow on otherwise good roentgenograms. The author employed the sodium salt of tetraiodophenolphthalein which was injected intravenously in 3–4 gm. quantities. Twenty-two of these cases were operated on and the gall-bladder was found diseased every time (histologically confirmed). Of the remaining 5 cases, 4 refused operation and the fifth was not advised operation because gall-bladder disease was not suspected. In 8 of the operated cases (4 with gallstones) none exhibited any obstruction, and there was no demonstrable hindrance to the outflow of the bile from the gall-bladder.

The color of the gall-bladder bile in roentgenologically non-demonstrated gall-bladders differed from that in the visible gall-bladder. In the visible gall-bladder the bile was dark to deep black, while in the non-visible gall-bladder it was always lighter colored (mahogany brown or olive green) if not containing whitish mucus. The latter suggests that either the liver secretes another kind of bile, or else more probably, that the bile in the gall-bladder is not concentrated in the usual manner. A determination of the bilirubin content may be used as a measure of the concentrating power of the gall-bladder.

In a series of exploratory laparotomies, the bile was removed through a fine needle from apparently healthy gall-bladders and the color in all cases was deep black with very high bilirubin values.

In the 8 cases above mentioned showing no cystic obstruction the bilirubin content of the bile was very low. This is regarded as clear indication that the gall-bladder mucosa has lost its concentrating power, and this is also the reason why the tetraiodophenolphthalein failed to concentrate sufficiently to a cast a shadow in the roentgenogram. The particularly important point established is that a gall-bladder may show hardly any external changes at operation, may appear perfectly normal, and yet may fail to give a roentgen picture owing to its inadequate functioning. Two examples are cited.

These observations may perhaps throw light upon certain obscure gall-bladder diseases. These are the atypical conditions described under such various names as pericholecystitis, periduodenitis, gall-bladder inflammation without stone, and mechanical cholecystitis. This is a field in which cholecystography may very well contribute important results. In the absence of cholecystography, puncture of the gall-bladder and examination of the bile will disclose the existence of a poorly concentrating gall-bladder. Such a finding would justify the removal of the gall-bladder. It still remains to be seen what the end effects will be in cases where such a gall-bladder has been removed.

GILBERT, MAURICE. Stereoscopic roentgenography in the diagnosis of pulmonary tuberculosis. *J. de radiol. et d'électrol., Par.*, July, 1926, x, 313–316.

Stereoscopic roentgenography has some very distinct advantages over ordinary roentgenography in examining the lungs. It makes it possible to dissociate certain circular false images due to the superposition of shadows in different planes which on an ordinary plate would look like a cavity. It is also very useful in differentiating pleural from intra-parenchymatous lesions. In therapeutic pneumothorax it gives a very good topographical idea of adhesive bands and in some cases makes it possible to distinguish between cavities and pleural folds which simulate them. And it is certainly superior to the ordinary plate with regard to detail and clearness of the pictures.

But the author does not agree with the enthusiasm expressed for the method by Dioclès in an article in the *Presse med.*, in August, 1925 in which he says that a stereogram can be read naturally and without any difficulty. Atmospheric perspective, on account of which in ordinary stereoscopy the most distant objects look the faintest because of the layers of air between them and the observer, does not exist in roentgenography. In place of it there is what may be called a perspective of opacity of the different tissues to the rays. This is one of the most difficult points in pulmonary stereo-roentgenography. The difference in opacity of the different tissues, the brighter and darker tones and the contrast between them give rise to errors of interpretation because of the optical illusions with regard to relief. Opaque bodies look closer than bodies that are permeable to the rays. Several times in stereograms representing the bronchi injected with lipiodol the author has seen pictures that, because of this optical illusion, looked as if the bronchi were outside the thorax, between it and the observer and this illusion was the same no matter whether the stereogram were placed in the normal or pseudoscopic position, that is whether the thorax is

looked at from in front or behind; and as a general thing the author prefers the posterior view because the perspective is easier to read. The posterior ribs are richer in calcium salts and give a darker picture than the anterior ones. The reading of the perspective is also rendered very difficult by the fact that some tissues and cavities are seen through others which are transparent. The conditions of accommodation are therefore essentially different from those in ordinary stereoscopy which gives a very different sensation of relief. Stereoscopic roentgenography is not capable of giving the localization and relief necessary for recognizing tuberculous cavities. Because of these differences from ordinary photographic stereoscopy the roentgenologist has to learn to read and interpret the stereogram, just as a person born blind who acquires his sight later has to learn to appreciate distance and relief. Stereoscopic vision in pulmonary roentgenography is by no means identical with photographic reproduction of normal vision in three dimensions.

Grauhan, Max. The diagnosis of cystic kidney. *Deutsche Ztschr. f. Chir.*, 1926, cxcvii, 205–231.

A functional test of the cystic kidney is indispensable in determining the stage of the disease and in establishing the prognosis in the individual case. The functional test is, however, not sufficient to establish the diagnosis where the palpatory findings are indefinite, because the results in early cases of polycystic degeneration deviate only slightly from the normal. The combined clinical, functional and roentgenological examination of cystic kidney permits a fairly accurate understanding of the condition and functional activity of both kidneys before operation. This has the advantage that a choice of suitable treatment can be made judiciously. There is no longer any need for a quick decision such as is necessary at the time of operation.

The age of forty to sixty years appears to be the most dangerous for those affected with cystic kidneys. Experience shows that the greatest danger is not from hemorrhage and infection but from uremia. Pyelography and pneumography are very important procedures in diagnosis. It appears that German authors have not fully appreciated the advantages of pyelography in the diagnosis of cystic kidney. Pathognomonic pictures by pyelography can be expected only if the calyx undergoes characteristic change during cystic degeneration. This is not yet certain for those cases in which the degenerative process is only recent.

Guinet, M., and Debasch, A. An unusual anomaly in the position of the stomach; intrathoracic stomach. *J. de radiol. et d'électrol., Par.*, June, 1926, x, 265–266.

Examination of a man aged sixty showed the stomach above the diaphragm behind the right lung, the fundus extending into the diaphragmatic cul-de-sac. The pylorus passed through the diaphragm at the site of the esophageal opening; the esophagus was normal in length so it made a decided curve in the picture. The stomach in making its movement of rotation could not occupy the left half of the thorax on account of the heart and so passed into the right half. The authors have found only one similar case in the *J. de radiol.*, 1922, and it was in a child of eleven.

The authors of that case had found 4 others in the literature. The patient in their case had never had stomach symptoms.

Guy, John, and Elder, H. C. A preliminary report on the radiographic exploration of the broncho-pulmonary system by means of lipiodol. *Edinb. M. J.*, May, 1926, xxxiii, 269–273.

In the diagnosis of certain bronchopulmonary conditions where the usual roentgenoscopic and roentgenographic study fails to give precise information necessary for a topographical diagnosis the employment of lipiodol may be very useful. The authors have employed this material with success and recommend the intercricothyroid route as the best for introduction of the lipiodol because the technique is easy and the patient is only slightly disturbed. A preliminary subcutaneous injection of morphine is not regarded as of any special use.

A detailed description is given of the technique of administration of the lipiodol. The site of injection is previously cocainized and the special needle for lipiodol injection is thrust perpendicularly into the cricothyroid membrane and the lumen of the trachea. If the cocaine solution has been correctly injected there is astonishingly little disturbance. Considerable pressure is required to inject the viscous lipiodol. The amount injected necessarily varies according to the age of the subject and the nature of the condition under investigation, the quantity varying from 8 to 10 c.c. for a child of seven to fourteen years up to 30 to 40 c.c. in the adult. The latter amount is amply sufficient to demonstrate the bronchopulmonary system of the adult in most pathological conditions. The authors consider oxygen inhalation an unnecessary complication in the

technique and have thus far seen no circumstance necessitating oxygen administration.

During the injection it is necessary to move the patient so that the lipiodol will gravitate toward the particular field under investigation. If too long an interval be allowed to elapse between making the injection and taking the roentgenogram the minutiae of the bronchial system, especially of the trachea and large bronchi, are to a large extent lost. Hence it is desirable to roentgenograph as soon as possible after the lipiodol has gravitated to the desired site; about two to three minutes appears to be sufficient.

Complications may develop if faulty technique causes injury of the tracheal mucosa. The trachea may be missed entirely and the lipiodol injected into the peritracheal cellular tissue. Despite careful antisepsis of the site of injection suppuration may develop from infectious material carried back from the trachea through the wound. Such suppurations respond readily to treatment. Exercise of reasonable care will avoid most complications.

HADEN, RUSSELL L. The value of the dental radiograph in detecting chronic periapical infection. *Illinois M. J.*, July, 1926, l, 62–66.

There is a question as to how far one may translate radiographic evidence of infection into terms of bacteria. Often certain tissue changes revealed by the roentgenogram are considered synonymous with infection. On the other hand, the possibility of infection is often excluded on the basis of roentgenographic findings. The problem is largely one of bacteriology. The author has made a step in this direction by culturing the apex and apical tissues from 1500 teeth, incisors, cuspids and bicuspids, which has been extracted without contamination. As a control, cultures were made of vital teeth by the same technique as that employed in culturing the pulpless teeth. The roentgenograms were made by a uniform method of exposure and development, at least fourteen films being taken for each patient so as to obtain at least two views of each tooth.

Four hundred cultures were made from vital teeth, 500 from roentgenographically positive pulpless teeth and 600 from roentgenographically negative pulpless teeth. The most noteworthy finding in the roentgen negative groups is the high percentage showing bacteriological evidence of infection without roentgenographic evidence, the incidence of infection being nearly as high as in the roentgen positive group. The organisms in most of the cultures were streptococci, and in a few they were mixed with staphylococci or Gram-positive bacilli.

HEATLEY, JOHN E. The oral administration of sodium-tetraiodophenolphthalein. *J. Oklahoma State M. Ass.*, August, 1926, xix, 224–225.

A brief outline is given of the technique in preparing the patient for cholecystography. The author regards this procedure as the most important advance made in roentgenography for several years, although sufficient observations have not been made to determine all the factors influencing the function of the gallbladder and the liver. There is as yet very little known as to the significance of the various types of shadows.

HENDERSON, MELVIN S. Chronic osteitis of the semilunar bone (Kienböch's disease). *J. Bone & Joint Surg.*, July, 1926, viii, 504–506.

This disease, of a chronic, slowly progressive type causing pain and disability, is a clinical entity, although not generally so recognized. The objective findings are often so slight as to justify a suspicion of malingering. In advanced cases, the roentgen findings are typical of osteitis with fragmentation and absorption of the bone. Roentgenograms made immediately after injury are negative, but they later show varying degrees of osteitis. There is no fracture in the typical case.

The syndrome in typical cases is characterized by three states: (1) the acute, lasting possibly only a few hours, coming on immediately after the injury, rarely lasting more than a few days, and generally not more than a few weeks; (2) the period of freedom from pain and disability lasting up to two months, and (3) the period of the actual disease in which the osteitis definitely assumes form and persists with symptoms perhaps for years. The nearest analogy to this lesion is the destructive process occasionally seen in a vertebra following an injury to the spine and known as Kümmell's disease. Two cases are reported.

HENIUS and BASCH. The frequency of occurrence of combination forms in pulmonary tuberculosis. *Beitr. z. klin. Tuberk.*, 1926, lxiii, 816–826.

Clinical observations show that during the course of a chronic acino-nodose pulmonary tuberculosis the disease may often times change and travel in one channel or another with high fever and speed. One can see roentgenologically in certain areas foci which correspond pathologically anatomically to exudative foci, and in other areas there can be quite as distinctly seen foci of the acino-nodose type or even cirrhosis. Oftentimes the pulmonary tuberculosis begins quite acutely in the exudative form, especially frequently after large

hemorrhages, however this exudative tuberculosis may develop into a chronic type which later will show acino-nodose centers as well as induration or cirrhosis. The important clinical point is that one is unable to distinguish in the roentgenogram the reversible exudative processes from the irreversible.

There are naturally a large number of cases in which from the beginning to end the picture of chronic acino-nodose tuberculosis runs true to form throughout and there are also the cases that show exclusively the exudative type. The point is emphasized, however, that in the average clinical course the pure types are rarer than the combination types. It is of course important from the standpoint of treatment to know which biological disease picture occupies the stage at the moment. Each patient consequently represents a special case, and therapeutic indications must be determined accordingly. Consequently, the treatment of pulmonary tuberculosi sis so difficult, precisely because these two types are found combined in so many cases.

Herrick, Frederick C. Pyelography in the diagnosis of tumors of the flank. *Ann. Surg.*, May, 1926, lxxxiii, 634–650.

Tumor masses occurring in the flank, i.e., that area bounded by the ribs, iliac crest and linea semilunaris, often present many difficulties of diagnosis. The history, clinical signs and results of general and local physical examination may be inconclusive, and the urologist may be sought for special evidence.

In such cases the author has made use of the device of placing a coin on the surface over the tumor and then making a pyelographic examination. This has enabled the differentiation of intraperitoneal from retroperitoneal masses (perirenal, subrenal and renal); (2) extrarenal (retroperitoneal) from intrarenal masses; and (3) intrarenal masses.

In making these differentiations use has been made of six factors as observed in the roentgenogram: (1) the position of the kidney; the normal being with its pelvis opposite the first or second lumbar intervertebral space. Variation from this must be explained by hypermobility due to one of the known causes, or displacement by tumor masses or drawing as by inflammatory processes. (2) Disturbances of the normal longitudinal renal axis. The normal direction is obliquely toward the spine cephalad, at an angle of 15°. (3) Disturbance of the normal anteroposterior axis or rotation of the kidney on its vessels as an axis. (4) Distortion of one or more calyces of the pelvis; typically seen as when caused by pressure on the kidney from an extrarenal mass. The entire pelvis and calyces are present but elongated or distorted by pressure. (5) Absence of a part or all of one or more calyces. This, in the author's experience, has been brought about most commonly by intrarenal masses, abscess or tumor, by which a calyx has been distorted or obliterated by pressure so that the contrast solution does not enter it. (6) Fragmentation of the pelvis or calyces which constitutes a typical picture of tumor close to the true renal pelvis.

Tumor outside the kidney is more likely to change the renal axis and distort the pelvis or calyces; while tumor within the kidney is more likely to obliterate or fragment the calyces. Twelve illustrative cases are cited and pictured.

Higgins, C. C. Chronic duodenal ileus. *Arch. Surg.*, July, 1926, xiii, 1–42.

Chronic duodenal ileus is not a rare condition and there are undoubtedly many cases that have not been diagnosed. Because of the severe headache associated with this condition a diagnosis of migraine is usually made. In all cases of severe headache associated with vomiting, a careful examination of the duodenum should always be made. Sometimes an accurate diagnosis is not made until the duodenum is exposed during an exploratory operation. Even the roentgenogram may not clearly define the condition.

The history and physical findings are important, as has been shown by the fact that in a few of the author's cases a correct diagnosis was made before the roentgen examination. However roentgenographic and roentgenoscopic examinations are of considerable value in many cases. Sometimes evidences of antiperistalsis, regurgitation of the barium meal into the stomach or of duodenal stasis may be secured roentgenoscopically while only a questionable roentgenogram is obtained. It should be realized that a pathologic condition may be present in the duodenum even if the duodenal cap fills perfectly. To eliminate duodenal stasis the duodenum should be observed at intervals for a period of from twenty to forty-five minutes. In many instances an enteroptosis or gastroptosis renders visualization of the third portion of the duodenum difficult, and a lateral view must be taken to secure a good picture.

Obstruction of the second portion is more readily visualized as the dilatation is frequently above the transverse colon and can be seen to the right of the stomach. Delay in the passage of barium through the duodenum is suggestive especially if the duodenum is constantly visible. Hayes' technique for visu-

alization of the duodenum should be used in suspected cases. Of course in all cases of acute dilatation of the stomach the condition should be suspected, and an attempt should be made to see whether change of posture will relieve the symptoms.

In cases in which the dilatation is insufficient to produce duodenal stasis and is associated with gastroptosis, an effort should be made to secure relief by non-operative measures. If the dilatation is marked and stasis with antiperistalsis is present, a duodenojejunostomy should be performed with the expectation of satisfactory results. Resection of the right colon is indicated in a few cases and should be performed only as a last resort. Gastroenterostomy should not be performed as the stasis in the duodenum is not relieved, and a vicious circle is established.

The author gives case reports of 57 patients, 31 of whom received medical treatment, 3 medical and surgical, and 20 surgical. The 3 remaining cases were diagnosed only.

HUBENY, M. J. The *X*-ray in appendicitis. *Illinois M. J.*, September, 1926, l, 235–236.

Because the appendix may have a physiological function, it should be studied roentgenologically before removal in suspected chronic cases. Because it possesses peristalsis, an appendix showing in the roentgenogram either retention or rapid expulsion of the barium is of diagnostic value. Because of its reflex influence over the alimentary tract, the appendix should be investigated by the barium method in many diseases of the stomach and intestines. The location of the appendix can be determined approximately even when not visible on the plate or screen because of the anatomical relation to the cecum. When barium-filled, the appendix can be studied roentgenoscopically in great detail and accurately palpated for pressure pain and adhesions. The time of examination is important, for the appendix commences to fill shortly after the cecum.

JUNGHAGEN, SVEN. Some cases of pulmonary atelectasis. *Acta radiol.*, June 30, 1926, v, 250–260.

An account is given of 3 cases of pulmonary atelectasis as a result of bronchial obturation. In the first case there was a foreign body in the main bronchus on the right side with total atelectasis of the lung after about twenty-four hours. In the second case, enlarged lymphogranulomatous glands compressing the upper right bronchus caused atelectasis of the upper lobe. The third case was that of an aneurysm compressing the main left bronchus and causing atelectasis of the left lung.

All 3 cases showed the characteristic roentgenologic changes, namely, haze over the affected lung field and shrinkage of the lung, together with secondary shrinkage phenomena of the thorax and mediastinum.

KIDNER, FREDERICK, C. An unusual case of Legg-Perthes' disease. *J. Bone & Joint Surg.* July, 1926, viii, 565–569.

The case occurred in a boy aged eight whose general physical examination was entirely normal with the exception of the lower spine, the left hip and thigh. There were also moderately enlarged tonsils.

The spinal roentgenogram showed nothing abnormal except occult spina bifida of the fifth lumbar vertebra. The hip showed great shortening of the neck of the femur with considerable increase in thickness. The appearance was as though the head had been completely destroyed and had left a rough superior surface to the neck. The head was represented only by three very faint shadows which might represent a disintegrated ossification center. The acetabulum was wider and flatter than normal and there was some loss of calcium in the left side of the pelvis. The only tenable diagnosis at this time seemed to be Legg-Perthes' disease or coxa plana.

At operation the head and neck of the femur were exposed through an anterior incision. The neck was much shortened and the head extremely flattened. The joint was found to be perfectly smooth and normal except that the cartilage was slightly yellower than usual. Two specimens were taken for pathological examination. The boy made an uneventful recovery after operation and the motion in the hip has become practically normal.

The tissue was examined by Dr. Phemister whose findings favored the view that the hip condition was the result of circulatory disturbance without existing evidence of inflammation. Since the process was of long standing any inflammatory signs, if present, might have long since disappeared. The opinion is expressed that despite the early age of onset the condition should be regarded as one of Legg-Perthes' disease.

KINGREEN, OTTO. The roentgen diagnosis of echinococcus. *Deutsche Ztschr. f. Chir.*, 1926, cxcvii, 83–90.

The diagnosis of echinococcus was easily established in 3 cases from the roentgen pictures. Should the cyst lie immediately above or below the diaphragm the roentgenogram does not furnish a definite conclusion as to the point of exit. A suppurated cyst broken into the pleura

cannot be diagnosed roentgenologically. The 3 cases are briefly described and pictured.

KINYON, WALTER G. The newer things in dentistry. *J. Mich. M. Soc.*, May, 1926, xxv, 209–211.

One cannot fix upon a diagnosis from the dental roentgenogram alone, but an intelligent interpretation of the shadows together with the clinical findings give a very accurate picture of the tooth condition under examination. One should not take the roentgen findings as final. Clinical tests should be made to discover if the shadows seen in the roentgenogram are due to the pathological process *per se* or to extensive instrumentation or medication.

It is quite impossible to diagnose pyorrhea alveolaris in a dental roentgenogram, but in the condition known clinically as pyorrhea alveolaris the roentgenograms will show much or little alveolar absorption according to the extent of the disease.

The full worth of the roentgenogram becomes self evident in those cases where the cause of pain is disclosed as due to impacted teeth, unerupted or malposed teeth, broken fragments of bone, injury by careless extraction, foreign bodies, etc. To the exodontist the roentgenogram locates the position of broken-off fragments; and the roots that would be next to impossible to extract if he did not know beforehand their exact position. To the orthodontist the roentgenogram gives a complete history of the case in hand. It tells how far the permanent tooth is taking the place of the primary dentition, what teeth are malformed and what teeth are malposed.

LAPENNA, MARINO. The mechanism and peristaltic function of the stomach studied by means of comparative diagraphs. *Radiol. med.*, September, 1926, xiii, 645–654.

Lapenna discusses the results of his study of the mechanism and function of the peristaltic movement of the stomach. For this purpose he made use of comparative diagraphs obtained by rapidly and accurately drawing the contours of the stomach and superimposing the roentgenoscopic sketches obtained in this way. A number of these diagraphs are reproduced. They are exact to the extent that they are sufficient to show even the slightest changes in peristalsis, such as the blocking of peristalsis in ulcer or cancer. In this way he found that peristalsis is continuous throughout the emptying time of the stomach. It is peristalsis that constitutes the mechanism of emptying, although gastric peristole contributes to increasing or diminishing the extent of the peristaltic movement. There are three fundamental types of peristalsis: digestive peristalsis, propulsive peristalsis, and expulsive peristalsis. Ordinarily peristalsis of the antrum does not have any autonomous movement; but it may acquire one when the body of the stomach is not capable of manifesting peristalsis as a result of infiltration and rigidity of its walls, as in cancer.

LAURELL, HUGO. Roentgenological signs of abdominal effusions. A contribution to the roentgen diagnosis of peritonitis. *Acta radiol.*, Jan. 15, 1926, v, 63–104.

When gas or free fluid becomes lodged between the intestines the latter, especially in their state of rest, assume a more regular, cylindrical form than they occupy normally. The normal angular form of rest of the small intestines may often be seen in small children as their intestines often contain gas. A pathological rounding of the intestinal lumina and of the intestinal sinuosities can be seen when free fluid is interposed (when the roentgen rays are suitably directed) if the intestines are meteoristic as in the case of certain types of ileus with free exudate or transudate. Small effusions which are not clinically demonstrable, the streaks of fluid lying between the abdominal wall and the gas-filled small intestines may be observed as wedge-shaped shadows. They are most easily demonstrable in the left flank. Sometimes a row of such wedges is connected with a narrow layer of fluid so that the shadow may assume a comb-like appearance.

The sub-peritoneal layer of fat normally visible in the flank between the intestinal and the abdominal musculature may be more or less strongly infiltrated when abdominal effusions are present, and consequently cast a stronger shadow than normally. The indirect signs of an inflammatory abdominal exudate are a paralytic ileus, a diminished mobility of the diaphragm and a secondary exudative pleuritis. In perforating peritonitis, free gas in the abdomen is also present. Various types of abdominal effusions are often accompanied by unilateral or bilateral pleural effusions. This may also occur in acute peritonitis, pancreatitis, intra-abdominal bleeding, tuberculous peritonitis, carcinomatous peritonitis, decompensated heart disease, etc. Study of the passage of the contrast meal may disclose that the small intestines lie farther apart than normal and that in the case of large ascites the small intestines do not reach the lateral abdominal wall. In the left lumbar tract, the small intestines may be observed to possess a freer passive mobility than normal because they are floating in the fluid.

In the case of large abdominal effusions the diaphragm stands high and there may be a diminution of its mobility. In certain cases there may be a flattening of the dome when the body is erect.

Encysted abscesses in the abdominal cavity may present themselves as homogeneous shadows surrounded by intestines heavily charged with gas. If a residual abscess is located in either flank, signs of meteoristic, abnormally rounded segments of the intestine, wedges of exudate between the intestines and infiltration of the layers of the abdominal wall should be sought, and in addition such indirect symptoms as may arise through pressure and deformation of adjacent segments of the intestine. Intestinal meteorism, local or general, is in certain cases regarded as an expression of serious local or general disturbances of the circulation. Seven illustrative cases are cited.

Levyn, Lester, and Aaron, A. H. Cholecystography by the oral method. *Radiology*, March, 1926, vi, 204–216.

The oral method of administration of tetraiodophenolphthalein has the distinct advantage of simplicity and none of the dangers of the intravenous method. Examinations in doubtful cases may be easily repeated and the diagnostic influences may be drawn in the same manner as from visualization made with the aid of the intravenous method.

The authors employ what is believed to be the simplest method of administering the dye orally, eliminating the uncertainties in the use of chemically hardened capsules, affording the greatest degree of protection against the acid of the gastric juice and making available for absorption the maximum amount of dye. This is accomplished by placing the dye in a No. 3 plain capsule which is inserted in a No. 0 size, the latter containing also sodium bicarbonate. These capsules proved superior to any of the other forms used and yielded the highest percentage of visualized gall bladders. It is recommended that the capsules be prepared freshly a short time before their administration.

The diagnosis of cholecystic disease should not be made merely upon marked variations of emptying time and mottled appearance of the gall bladder, until after large numbers of operative and pathologic reports establish their complete significance. Accurate interpretation of visualization and non-visualization will be attained only after full collaboration between pathologist, roentgenologist and surgeon.

The above conclusions are based upon experiments in which 160 patients, divided into four groups of 40 each, were tested as to the visualization produced with (1) ordinary double capsules containing 0.25 gm. of the tetraiodophenolphthalein salt; (2) gelatin-coated capsules; (3) formalinized capsules, and (4) double capsules with sodium bicarbonate between the inner and outer walls.

Lyon, B. B. V. The evolution of early to late gall-tract disease; brief consideration of its diagnosis and treatment. *Radiology*, April, 1926, vi, 279–285.

In certain cases, early catarrhal process may remain localized in the cystic duct alone and may produce retention of gall-bladder bile with resultant damage to the gall-bladder mucosa and walls. This condition is accurately recognizable by only two diagnostic procedures: by biliary tract drainage study or by cholecystography. The latter, however, cannot differentiate between cystic duct obstruction due to catarrh and that due to adhesions, stone impaction, stricture, angulation of duct, etc. Cystic duct obstruction due to catarrh gives an abnormal drainage sequence and a characteristic microscopic picture.

In those cases of early gall-bladder disease which are non-surgical, in which the clinical symptoms and roentgen signs are uncertain, the use of the duodenal tube with microscopic and cultural tests will reveal the condition. This requires an experienced observer. In the later stages of gall-bladder disease, the clinical and roentgenological signs become more definite. Cholecystography is now recognized as a great advance in the diagnosis of gall-bladder disease, but because the cholecystographic method gives no information regarding the state of mucosal integrity it still misses recognition of the early cases during the incubating period because the wall of the gall bladder has not become sufficiently damaged. Roentgen study will recognize more definitely angulations or diverticula of the gall bladder than any other non-surgical method. The duodenal tube can only suggest these conditions but cannot differentiate them.

Macchiarella, Biago. Roentgen examination and topographical diagnosis of subphrenic hydropneumocyst on the right side. *Radiol. med.*, July, 1926, xiii, 495–504.

Three cases of intrahepatic hydropneumocyst are described, the first of which followed a suppurated echinococcus cyst, the second was a complication of dysentery and the third followed an echinococcus cyst of the liver that had already been operated upon twice. The

author believes that the possibility of an intrahepatic localization of the cyst should be thought of more frequently than it is in subdiaphragmatic cyst. The possibility of an intrahepatic hydropneumocyst should be very strongly considered when in subphrenic cyst on the right side the mobility of the diaphragm is undisturbed, there is no pleural reaction and when on oblique and latero-lateral projections the cyst seems to keep its central position in the liver shadow which moves normally with respiration, leaving the outline of the liver shadow free. If in addition to such roentgen signs there are indirect signs, such as normal mobility of the stomach and intestines, and if there are any clinical and historical data to indicate it a definite diagnosis of intrahepatic cyst may be made.

MacRae, John D. X-ray diagnosis of pulmonary tuberculosis in children. *Radiology*, May, 1926, vi, 417–418.

Lymphadenoma from tuberculous or other infections presents the same appearance, so that the diagnosis is dependent on a study of history and symptoms as well as on the roentgenographic signs. The symptoms may be out of proportion to the extent of glandular involvement. Glandular hypertrophy may be followed by resolution, but oftener caseation and fibrosis or calcification takes place. Repeated roentgenographic examinations show the glands to be disappearing or becoming smaller and more dense. On the other hand, caseation is followed by liquefaction and the infected material may be widely disseminated in the blood stream and produce miliary tuberculosis; or the necrotic gland may rupture into a bronchus and be aspirated into the lung where areas of caseous pneumonia will develop.

A hypertrophied lymph node obstructing the return of blood and the flow of lymph to the hilum causes a retrograde lymphangitis to develop in a trunk which eventually recedes, leaving a nodule where arrest or healing has taken place. It is some modification of these processes which produces the hilum type of tuberculosis or the basal type which are occasionally seen in children. The adult type of tuberculosis in children occurs when the patient has developed some degree of relative immunity through repeated mild infections with the tubercle bacillus, and this condition is characterized by the fibrous tissue deposited at the site of infection.

Madlener, Max. Tuberculosis of the os pubis. *Deutsche Ztschr. f. Chir.*, 1926, cxcvi, 329–335.

Tuberculosis of the os pubis is a very rare condition and the author's experience shows that if there is prolonged fistulation in this region, suspicion of tuberculosis may be entertained, and a pelvic roentgenogram will confirm the diagnosis. This disease has been reported in the literature in 33 cases and the author adds 5 more which have been observed in the past two years.

In the author's cases the local roentgenogram showed in the region of the fistula a washed out appearance of the bony structure, (rarefied), the vicinity of the foci showed no sclerosing processes but rather partial atrophy, and the periosteum disclosed no stratification. Other manifest tuberculous foci in addition to the involved os pubis were found 3 times.

The treatment consisted of strict rest in bed and nourishing diet, local roentgen irradiations and sun baths of the whole body. Some of the cases required operative treatment. The question as to whether conservative treatment will suffice or not depends on the nature of the individual case. The prognosis so far as the local condition is concerned is favorable.

Marietta, S. U. Abscess of the lung. *Am. Rev. Tuberc.*, August, 1926, xiv, 107–134.

The diagnosis of abscess of the lung is one of elimination. The history is of great importance. Any failure of resolution or clearing up of the pulmonary tissue following an infectious disease therein (lobar pneumonia, bronchopneumonia, influenza, etc.), symptoms indicating localized pulmonary involvement after a general anesthetic especially when given for operative procedures on the upper respiratory tract, or the presence of non-suppurative processes elsewhere in the body should always cause one to think of lung abscess.

The roentgen ray is of great value in the diagnosis and it is absolutely necessary for the definite localization of a pulmonary abscess. Thickened pleura, if marked, or a prominent area of pneumonic reaction about an abscess may vitiate the information to be obtained roentgenographically. The plates should be stereoscopic, and as the definite localization of the condition may be the deciding factor in the method of treatment to be followed, it is advisable to take both anteroposterior and lateral views. It has been stated that the judicious use of sedatives for twenty-four to forty-eight hours preceding roentgen examination is helpful, as there is an accumulation of secretion and thus exaggeration of the signs. The physical signs are not very characteristic, only serving, as a rule, to show the presence of the localized area of involvement in the lung. The use of the bronchoscope had best be left to

those special clinics where an expert in its use is present. The diagnosis of lung abscess necessitates a differential diagnosis from bronchiectasis, gangrene, encysted empyema, pulmonary tuberculosis and lung tumors. In all of these the roentgenogram is of great assistance.

The author has observed in the hospital at Fort Sam Houston 15 cases of single and 2 of multiple lung abscess. The etiology in one case was extension from an amebic liver abscess, in 6 lobar pneumonia, in one the abscess followed tonsillectomy, and in one bronchopneumonia; in 8 the etiology was undetermined. The infecting organisms were streptococci in 3 cases, pneumococci in 4 cases, mixed streptococci and staphylococci in 3 and unknown in 7. Only 6 of the cases, all with single abscesses, were chronic, the rest being acute. Of the 17 cases, 7 were cured, 2 improved, one unchanged and 2 remaining in the hospital. There were 5 deaths (including the 2 cases of multiple abscess).

Six of the cases are reported, one or more of the serial roentgenograms being presented in each case as illustrative of certain pathological types or of changes taking place under treatment.

Meldolesi, Gastone, and Meldolese, Gino. Roentgen study of heart pulsations in physiological and pathological conditions of the circulation. *Radiol. med.*, September, 1926, xiii, 597–629.

The authors made diagraphic outlines of the pulsation of the left lower arch of the heart in extreme positions of systole and diastole. They preferred the simple diagraphic method to the orthodiagraphic or teleroentgenographic one, as they find it more accurate. All of the subjects were carefully examined clinically and the clinical data recorded in connection with the heart diagraphs. A number of diagrams are given showing the position of the left lower arch of the heart in systole and diastole in normal subjects and in various heart lesions. They find that there are characteristic diagrams not only in the various heart lesions but also in different types of normal subjects, so that this method may be used in the study of types of constitution.

Monari, Augusto. A post-traumatic cerebral pneumoventricle. *Radiol. med.*, July, 1926, xiii, 492–494.

A boy of ten was injured in an automobile accident and brought as an emergency case to the hospital with signs of concussion of the brain. He presented a fracture of the vault and base of the skull and a large scalp wound. Roentgen examination showed fracture of the temporal and parietal bones, and the presence in the midst of the cerebrum of two transparent zones the form of the cavity of the lateral ventricles, showing that air had entered these ventricles. As to the portal of entry and the route which the air had taken to enter the ventricles, the author concludes that the air entered through the scalp wound and the fracture of the skull into the subarachnoid spaces and then passed into the fourth ventricle by the foramina of Magendie and Luschka, and finally reached the lateral ventricles through the Sylvian aqueduct, the third ventricle and the foramen of Monro. The case ended favorably and the patient left the hospital at the end of two months completely cured.

Montanari, Arrigo. A special displacement of the last loop of the ileum from pressure exercised by abdominal tumors of pelvic origin. *Radiol. med.*, June, 1926, xiii, 416–420.

Montanari has found that during the last months of pregnancy the terminal loop of the small intestine passes horizontally across the abdomen from right to left at or about the level of the umbilicus. He thinks that this is a normal and regular position in pregnancy and that it may also be caused not only by enlargement of the uterus but by enlargement of the bladder or rectum as well as by tumors of pelvic origin in general when they have enlarged so as to fill the lower part of the abdomen. In fact he first saw it in a case of abdominal tumor and in this case it has been fixed in the abnormal position by adhesions.

Mouchet, Albert, and Belot, J. Tarsomegaly. *J. de radiol. et d'électrol., Par.*, July, 1926, x, 289–293.

The authors presented a child three years of age whom they had followed up to the age of two and a half years. Ever since his birth he has shown a considerable hypertrophy of the astragalus and of the malleolus of the tibia of the left foot which has caused a talipes valgus. Associated with this hypertrophy of the astragalus and malleolus the third cuneiform is somewhat enlarged in all its diameters and the centers of ossification of the scaphoid and 1st and 2d cuneiform appeared much too early. They ought to appear at the end of about two years and a half, but they apeared before eight months, and at two years and a half the scaphoid was as large as the cuboid. The first and second metatarsals on the left are 2 mm. longer than those on the right. The toes are normal. They think it is a congenital defect of development analogous to the congenital hypertrophy in macrodactylia and therefore they give it the name of tarsomegaly. They

have never seen a case described in the literature. The child was born normally, his nutrition is perfect and he shows no signs of rickets or syphilis. Wassermann reaction negative in him and in his parents. The deformity of the foot does not seem to have increased for the past year. They think it will have to be operated upon later.

NAEGELI, TH. The significance of the roentgen picture in the diagnosis, therapeutic indications and the evaluation of the result in surgical tuberculosis. *Strablentherapie*, 1926, xxi, 342–352.

This is a general lecture giving an outline of the relation between the pathology and the roentgen findings in surgical tuberculosis, and suggesting the general principles that guide in the treatment of suitable cases.

As regards diagnosis, the most important item is the recognition of the type of tuberculosis present. In the fibrocirrhotic and cavernous forms which from their nature have a healing tendency, the aim should be to support and augment this tendency. The exudative form which is prognostically more unfavorable is, on the other hand, only rarely suitable for surgical treatment. The roentgenogram permits a differential diagnosis of certain lung conditions that may resemble tuberculosis.

An extensive roentgenological experience combined with a knowledge of the pathologic anatomical factors is necessary to enable one to make use of the roentgenological findings in the selection of cases of pulmonary and bone tuberculosis for surgical treatment.

Repeated irradiations of tuberculous tissue may lead to undesirable effects. This, however, is minimized under present conditions of roentgen technique.

NEUSWANGER, C. H. Iodized oil as a pyelographic medium. *Surg., Gynec. & Obst.*, August, 1926, xliii, 169–176.

The iodized oil used was an emulsion of 90 parts of iodipin (40 per cent, Merck) with 10 parts of neutral soap solution. The soap solution was added because it was found that the original solution flowed with some difficulty through small ureteral catheters. The slight decrease in the opacity of the emulsion was found to be negligible.

The iodized oil was used upon a series of laboratory animals as a pyelographic medium giving excellent results and giving no evidence of toxicity or irritation in the urinary tract. When injected into the venous circulation in dogs in large amounts, it was found to cause areas of temporary congestion with hemorrhage and infiltration of the lung alveoli; but animals observed for a period of two months showed no untoward symptoms. The iodized oil was found to possess no appreciable bactericidal or bacteriostatic action.

In the clinic, very satisfactory ureterographic and pyelographic shadows were obtained when the emulsion of iodized oil was used. This was true in 2 cases when previous pyelograms and ureterograms made after the injection of 12.5 per cent sodium iodide failed to cast a shadow sufficient for diagnosis.

Iodized oil was found to be especially useful in obese patients and even a small injection of 1 to 2 c.c. into the ureter gave a very dense shadow. Ureteral injections were found to be more complete with iodized oil than with sodium iodide in several instances in which a direct comparison was made.

The oil was found to escape readily from the urinary tract and a roentgen examination twelve hours following an injection gave no evidence of residual oil within the renal pelvis or ureter.

The iodized oil was employed with good results in a series of 27 cases in the Department of Surgery, Yale School of Medicine. Some of the patients examined had had marked destruction of renal tissue, but the oil injections were borne without symptoms of irritation or evidence of harmful effects upon the diseased kidney. Five cases are briefly described and illustrated.

NEWELL, QUITMAN U. The use of iodinized oil (iodipin) as a diagnostic aid in gynecology. *Am. J. Obst. & Gynec.*, August, 1926, xii, 189–199.

The author, summarizing his personal experience to date, states that iodipin injections will prove of diagnostic value (1) in sterility cases where the tubes are found obstructed, to determine the character and location of the obstruction. It offers the opportunity of deciding definitely whether or not the case is suitable for operation. (2) When several masses are palpable within the pelvis, injection and roentgen study will clearly differentiate the uterus from the other masses. (3) In cases in which the pelvis is blocked by one large mass. By this method, the precise diagnosis can be made as to whether the tumor originates from the ovary or the uterus. (4) In cases in which a foreign body is suspected within or outside the uterine cavity.

Iodipin injections into the uterus prove helpful in differentiating chronic appendicitis from a right sided salpingitis, and a tuberculous salpingitis from common salpingitis, which means that they might possibly enable one to

make a definite diagnosis of a tuberculous tube.

The method is an invaluable aid in indicating the size of the uterus and determining whether the cavity is encroached upon by any masses such as a fibromyoma, a carcinoma of the fundus, etc. Iodipin injections carefully and skillfully done are not likely to be harmful to the patient.

In 38 cases injected in the course of three months the author has not observed a single unfavorable reaction. There was occasion to open the abdomen of 30 of these cases at various intervals from one to fourteen days after the injections, and no irritating effects were seen of the iodized oil on the tissue of the pelvis in cases where it had passed through the tubes. It would seem that the oil is ultimately eliminated. The exact time of the disappearance of the oil from the pelvis has not been ascertained, but it appears certain that the absorption is relatively rapid and is not a matter of months as in the case of injections into the spinal canal.

NICOLSON, WILLIAM P., JR. Gastric carcinoma with report of three cases of apparent cure. *J. Med. Ass. Georgia*, July, 1926, xv, 272–276.

An early and thorough roentgen examination should be made in all cases of suspected gastric malignancy. In cases where there is definite evidence of metastasis or where the general condition of the patient is poor or where roentgen examination shows extensive involvement about the cardiac end, exploratory operation is probably not advisable; but in practically all other cases it is and the sooner performed the better. The mortality from a simple exploration is exceedingly low. Radical resection of the stomach is the operation of choice when possible. In selected cases if operated on early and given postoperative roentgen treatment the chances for cure seem good.

Three cases are reported. The first is a case of a man aged thirty-nine who was operated on in 1912 and is living and well at the present time. The second was in a man aged sixty-two who is now living more than five years after operative removal of a definitely proven adenocarcinoma of the stomach. The third case occurred in a woman aged sixty-two who was operated on for an early carcinoma of the stomach and is living more than three years after operation with no evidence of a recurrence.

PERONA, PIETRO. Anomalies of the ribs and their importance in the roentgen examination of the respiratory tract. *Radiol. med.*, July, 1926, xiii, 465–486.

During the past year Perona has made a systematic search for anomalies of the ribs in the patients sent to him for examination of the chest for the purpose of determining the importance of some of these anomalies in diagnosis of diseases of the lungs. His statistics cover 1352 subjects in whom a complete roentgen examination was made. He finds that there are certain anomalies in the number of the ribs, cervical or supernumerary ribs, and that these occur in about 10 cases out of 1000, while anomalies of form occur in about 12 out of a thousand. Anomalies in the number of ribs are found in two-thirds of the cases in women, while nine-tenths of the cases of anomaly of form are found in men, and in the majority of cases on the right side. There is no explanation of this difference in any of the theories as to the etiology of these anomalies.

The number of ribs may be increased or decreased; if there is a decrease it is at the expense of the 12th rib which is fused with the 12th dorsal vertebra and transformed into a mere costiform process. No cases of disappearance of the 1st rib have been reported, although it is sometimes found in a rudimentary form. But a supernumerary rib may precede the first or follow the 12th rib. Only two of his cases with a supernumerary first rib showed any clinical symptoms, although they included all the forms of Gruber's classification. These two patients had pain in the region of the apex which he thinks was due to irritation from the floating anterior end of the rib. One of them said that the pain was always worse in the spring when his upper respiratory tract was congested. The end of a floating supernumerary first rib may be projected on the clear apex space and as it moves synchronously with the apex when the patient breathes deeply or coughs it may be taken for a shadow in the apex. A fixed first cervical rib only barely touches the edge of the apical space, and so is not apt to lead to a mistaken diagnosis, but, on the other hand, it is apt to be overlooked altogether, especially on roentgenoscopic examination. A roentgenographic examination should always be made to determine the relation of these supernumerary ribs to the first true rib and to the vertebrae.

Anomalies of form almost always affect the anterior end of the rib and may very readily be mistaken for lung shadows, particularly when they lie near the hilus where it is harder to differentiate shadows. The first rib may be fused with the second, or cartilage or a mere ligament may be substituted for the central part of it, only the vertebral and sternal parts being made up of compact bone. In the latter cases there may be pain, limited to the cartilaginous portion of the rib and generally due to the patient's occupation. The one patient of this type that the author had was

accustomed to carrying heavy loads on his shoulders and when he stopped work the pain disappeared. The most common anomaly of the other ribs is a bifurcation of the anterior end of one rib, accompanied generally by defective development of the adjacent ribs. This anomaly is found chiefly in the 3d, 4th and 5th ribs of the right side.

The various anomalies are illustrated by roentgenograms.

PHILIPS, HERMAN B. Paget's disease. *J. Bone & Joint Surg.*, July, 1926, viii, 643–650.

Paget's disease manifests itself with definite roentgenological characteristics permitting a definite diagnosis whether the disease is local or general. The latter part of this statement would be probably more exact by qualifying it as early or late. General roentgen examinations are advisable in all cases of suspected Paget's disease for the purpose of accumulating data on the relative incidence of the bones involved and for the elaboration of diagnostic information. Characteristic changes in the pelvis are frequent and permit a definite diagnosis in the absence of skull manifestations.

When the involvement is early, faint striations are usually seen in the ischium or pubes. Subsequently the ilia become involved. When the disease is still further advanced marked bowing deformities of the pelvic walls occur with marked protrusion of the acetabula into the pelvis producing the characteristic Otto-Chroback deformity. Frequently, the pelvis is involved to such an extent as to be the basis for a positive diagnosis when the skull may show no changes whatsoever. This has been observed at least six times in the author's experience.

POWELL, C. B. Roentgen-ray diagnosis of the diseases of the thoracic viscera. *J. Nat. M. Ass.*, April–June, 1926, xviii, 73–75.

Tuberculosis manifests itself on the roentgenogram in three forms: (1) parenchymatous; (2) peribronchial, and (3) miliary. Parenchymatous tuberculosis in its earliest stages in the adult is regularly found somewhere in the upper lobes near the apex and is nearly always unilateral. Small, circumscribed areas may appear on the plate and these may be solitary or occurring in groups of smaller shadows of indistinct outline. The pulmonary markings are increased in size, number and density in the region and show a tendency to conglomeration. The examination of the lung should be made not only in the roentgenogram but also roentgenoscopically.

Peribronchial tuberculosis is the affection around the bronchi causing a proliferation and thickening of the bronchi which appears on the plate as a disc of increased illumination with bands of opacity. Miliary tuberculosis is differentiated by the pneumonic fields being peppered with small tubercles giving the appearance of cottony flakes in the acute case or of small shot in the chronic case.

The shadows in pneumonia owe their differentiation to variations dependent on the nature of the exudate and on the lobar distribution of the shadows. Opacities can be accounted for as the result of consolidation and the shape of the indurated lobe.

The lesions of early or active syphilis produce shadows which are to be interpreted as gummas or inflammatory consolidations or infiltrations. The lesions of old or latent syphilis produce shadows which represent interstitial fibrosis, periarterial fibrosis or dense fibrosis of the lung and pleura. One should be cautious about diagnosing syphilis of the lung even in the frankly luetic patient.

Hodgkin's disease is generally shown by a paratracheal shadow projecting beyond the mediastinum, with a border irregular in outline or circumscribed and regular and extending over a considerable portion of the mediastinum. The masses may reach a large size extending beyond the nipple line and up to the clavicle. Lymphosarcoma starts in the mediastinum and increases rapidly in size to involve the lung and pleura. The shadows are homogeneous and dense; they are nearly always bilateral which serves to differentiate them from primary tumors of the lung. The lobulated border is the most constant roentgenographic feature. An enlarged thymus casts a small inverted heart shaped shadow which overlaps the aorta and the base of the heart. Cysts cast shadows generally well circumscribed and of uniform density. Dermoid cyst is characterized by a clear cut border which circumscribes a roundish dense area projecting from the right mediastinum.

Malignant tumors of the lung involve primarily or secondarily the lungs, bronchi and pleura. Of the malignant tumors of the lung, carcinoma is by far the most frequent. The roentgen picture in this type of tumor is so well known that one may infer from the roentgenogram the particular type of tumor one is dealing with.

RANDALL, LAWRENCE M. Lipiodol as an adjunct to tubal inflation in the diagnosis of sterility. *Am. J. Obst. & Gynec.*, September, 1926, xii, 326–331.

Lipiodol offers a further means of accurately diagnosing tubal obstruction and stenosis as a cause of sterility in women. After tubal infla-

tion has shown non-patency or stenosis of the tube, the site of closure or stenosis can be accurately detected with lipiodol. This information is of value in considering the advisability of surgical intervention in an otherwise normal pelvis. Such tubes are always symptomless and frequently unaccompanied by other pelvic lesions, hence there would be no other indication for operation.

As a rule, women who consult physicians primarily because of sterility are otherwise normal, and it is not justifiable to subject them to surgical operation without the benefit of as accurate a diagnosis as possible. Uncomplicated tubal occlusion is a frequent cause of sterility and the question of laparotomy is often brought up by the patient. If the site of closure can be located, one can much better judge the value of operation in a given case. Should the obstruction be in the narrowed portion of the tube, the prospect of success from a plastic operation of the tube will not be good. With pathologic change at the fimbriated end, which is relatively common, and the lumen patent to this point, operation may be justifiable. It carries with it a fair chance of success provided other conditions are normal. Three illustrative cases are cited.

The technique of injecting the lipiodol is simple and involves no special apparatus. Ten cubic centimeters of the oil is sufficient for an ordinary case, and often 5 to 7 c.c. is enough. The injection is practically painless, the technique demanding the same care that is used in transuterine inflation of the tubes by the method of Rubin.

Rongoni, Luigi. Clinical and roentgen study of the etiology and pathogenesis of Osgood-Schlatter's disease. *Radiol. med.*, August, 1926, xiii, 557–562.

The author describes 5 cases of Osgood-Schlatter's disease in which both the clinical and roentgen pictures indicate strongly that it was due to inflammation with reaction of the tissues around the bone; there was no history of trauma and no history or evidence of syphilis, tuberculosis or late rickets. A study of the clinical course of these cases which began with fever and pain seems to show that an inflammatory element is necessary to produce the clinical picture of this disease which generally affects subjects of delicate constitution in whom the action of the bacteria or toxins is facilitated by a preexisting condition of insufficient development of the centers of ossification or by a condition of dysplasia. In all probability various forms of pathogenic bacteria may act on the anterior tuberosities of the tibia in adolescents.

Rusconi, Matteo. Enterolith without occlusion observed a long time after a barium meal. *Radiol. med.*, July, 1926, xiii, 487–491.

A man aged seventy-three was sent for roentgen examination because of a suspicion of gastric ulcer. The results were indefinite and he was told to return a month later for another examination. On this examination an intensely opaque shadow about the size of a hazelnut was seen in the left flexure of the colon which on respiratory movements followed the colon. On various examinations practiced for a period of eighty days the shadow was always found in the same place. As this shadow was not found on the first examination the conclusion was reached that it must be due to the barium given at that time, but the question remained of what could have caused its arrest in the colon. Solitary diverticulum of the colon is rare. They generally present multiple rounded shadows smaller and less dense than this one. At the end of the eighty days the patient came and reported that the day before he had had nausea and vomiting and had taken a saline purgative after which he passed a copious stool containing eight or ten small whitish bodies. Another roentgen examination showed that the shadow in the colon had disappeared. The enteroliths, which were evidently fragments of the one that had caused the shadow contained calcium salts and a still larger proportion of barium salts. The author concludes that there had probably been a pseudodiverticulum of the colon caused by pericolitis and that adhesions had bridged a haustrum, retaining a small mass of fecal matter.

Schiessl, M. Fractures of the transverse process of the spine. *Deutsche Ztschr. f. Chir.*, 1926, cxcvi, 297–306.

Recognition of this form of fracture was rare before the advent of roentgen rays. Roentgenograms show that fractures of the transverse process are often associated with fractures of the vertebral bodies. Isolated fractures of the transverse process have been described only recently as occurring exclusively in the lumbar spine. The author has had good opportunity to observe a number of cases in a mining community in Alsace. The material confirms the fact that most of the fractures occur in the lumbar region, but he has observed 2 cases in which the fracture of a transverse process occurred in the thoracic spine.

A total of 23 cases of isolated fractures of the transverse process of the lumbar spine was observed from 1919 to 1925 and these are briefly cited.

There is no distinctive symptom-complex associated with these fractures. The local

pressure pain, blood effusion and restricted motion, are also present in contusions and distortions without involvement of the bone. The degree of disability is extraordinarily variable, and frequently patients walked to the doctor's office for examination. The precise recognition of the condition can be made roentgenographically. It is nowadays absolutely necessary to subject to roentgen examination all cases with local pressure pain in the region of the lumbar spine. As a result, many cases of lumbago, contusion and distortion become unmasked and are shown to be transverse fractures. In the roentgenogram, the true fracture shows itself by the presence of distinct diastases in the transverse process, or at least fracture lines with displacement of the fragments toward each other. To regard linear shadows or thickenings as old fractures is not always justifiable where epiphyseal lines are present since it has been shown that the transverse processes of the first lumbar vertebra can retain these epiphyseal lines even after the individual has attained the age of twenty-five. Characteristic for the isolated transverse fractures in the lumbar vertebrae is their unilateral occurrence. Only 2 of the author's cases showed bilateral fractures. The treatment is immobilization, and the end results are good. In only one case was the occupational activity of the patient limited as a result of the fracture.

Scott, S. Gilbert. Secondary jejunal ulcers and their radiological diagnosis. *Lancet*, July 31, 1926, ii, 222–224.

Primary jejunal ulcers, that is, those ulcers which form primarily in the jejunum, not secondary as the result of a gastroenterostomy, are extremely rare. Secondary jejunal ulcers, however, are a serious drawback to the otherwise valuable operation of gastroenterostomy for gastric ulcer. As in gastric work, roentgenograms alone are of little diagnostic value, because most jejunal ulcers are extremely difficult to record on a roentgenogram even after they have been located on the screen. Under present conditions roentgenologists should not give a diagnosis of an organic lesion of the intestinal tract unless the lesion has been visualized on the screen. The hand and eye properly trained are of greater diagnostic value than roentgenograms, and direct evidence of *gastric* lesions in nearly 100 per cent of cases is believed possible in the near future if this fundamental fact is thoroughly grasped and recognized.

The roentgenologist in the course of his gastric work examines many cases where symptoms point to ulceration of the jejunum after gastroenterostomy, but such ulceration is probably seldom detected. The large majority of these ulcers can however be located accurately. The method to be followed is based on the same principle as that used in gastric work, that is, systematic roentgenoscopic palpation. It takes time and perseverance to become proficient in the art of palpation.

The main features of the method are as follows: A meal of creamy consistency is used and only a small quantity (3 oz.) of this is administered at first. This is important as a full meal of 6 to 7 oz. will defeat one's object. By means of pressure of the hands on the abdomen the opaque substance comes under full control. It is then possible to smear the cream over each section of the mucous membrane systematically. This procedure is termed by the author as "whitewashing" the interior of the stomach. The systematic examination of the whole stomach and duodenum must be emphasized, that is the whitewashing process must start at the cardiac end working down inch by inch and ending at the jejunum.

Seydell, E. M. Foreign bodies in the air and food passages with case reports of unsuspected foreign bodies. *J. Kansas M. Soc.*, July, 1926, xxvi, 220–223.

It is important that both anteroposterior and lateral roentgenograms be made when hunting for suspected foreign bodies in the air and food passages. A metallic foreign body will be clearly shown in a good roentgenogram. Bones and similar material are not easily shown. Non-opaque bodies in the lung, especially nuts, peas, etc., give roentgen pictures which agree with the physical signs as follows: (1) increased transparency on the obstructed side; (2) displacement of the heart toward the uninvaded side; and (3) downward displacement of the diaphragm and limitation of motion on the obstructed side.

Four cases are cited showing the necessity for every physician to bear in mind the possibility of a foreign body in the air and food passages even when there is no direct history suggesting it.

Willis, T. A. Pott's abscess. *Surg., Gynec. & Obst.*, September, 1926, xliii, 285–292.

A detailed study was made of 4 tuberculous vertebral columns from cases having no known history of syphilis or gross evidence of this disease. Roentgenograms of the cadavers showed cold abscesses of the vertebral columns at the cervical, upper thoracic, thoracicolumbar, and lower lumbar areas; also of the manubrium sterni. These findings indicate the possibility of multiple lesions in Pott's disease with

consequent necessity of a thorough roentgen examination to disclose them. There was also evidence of productive changes in the bone in active tuberculosis, as well as in old healed specimens. The frequency of involvement of articular and muscular processes in addition to the vertebral bodies is also noted. Even in extensive lesions there was a notable absence of angulation or other deformity. The coexistence of extensive lesions with merely superficial erosion of the bone is emphasized.

There was also observed great frequency of abscess formation and the subdivision of the abscess into successive pockets effectually shut off from the thoracic and abdominal cavities but open dorsally between the transverse processes and ribs. There is clinically a fixation of the abscess walls to the middle of the vertebral bodies, and not to the intervertebral discs as would be suggested by the anatomical descriptions of the anterior common ligament.

ROENTGEN AND RADIUM THERAPY

Cabanes, M. A case of propagation of uterine cancer after radium therapy. *Bull, Soc. d'obst. et de gynéc. de Par.*, 1924, xiii, 507.

A case is reported in which a uterine cancer was treated with radium and was successfully destroyed, leaving only a scar. Two years later the uterus was apparently normal, but there had developed in the anterior wall of the vagina a tumor the size of a small nut. The explanation is that either this is the delayed development of a tumor that was already started, or else the refult of the irritation of these tissues by the weak irradiations of radium from the treatment of the other cancer distance being effective in only stimulating growth of tissue. In treating the first uterine cancer 7 omgm. of radium were used and placed for five and six days in the uterus.

Couvelaire, Portes, and De Nabias. Treatment of cancer of the uterus during gestation and parturition by combination of curie-therapy and surgery. *Bull. Soc. d'obst. et de gynéc. de Par.*, 1924, xiii, 417.

Cancer of the uterus, accompanied by metrorrhagia and much pain, was treated during gestation with radium with favorable results to mother and child. The cancer was a malpighian epithelioma; a total of 54.60 millicuries were used, 36 in the abdomen and 18.60 in the vagina. The results of these treatments were such that birth of the child was made possible with no serious effect on the mother, whereas the prognosis before treatment was very discouraging.

Daels, Frans, and Backer, P. De. New techniques of "Curie" therapy of cancer of cervix uteri. *Brit. J. Radiol.*, September, 1924, xxix, 315–322.

Despite inadequate technique, of 23 patients treated in 1921 with radium, 8 have remained cured and one could not be traced. Only 3 of the 23 could be regarded as operable cases, and amongst those cured there were some about whom not the slightest hope of cure could be entertained. Another fact to be considered is that radium puncture of cancerous glands should be condemned, and that external radium therapy is to be preferred to roentgen therapy for the treatment of these cancerous glands. The external radium therapy of cervical cancer cannot be carried out by placing radium tubes around the pelvis, but it is practicable by placing these tubes within the pelvis and over the affected glands.

The radium cartridges contain 3.3 mg. radium element and are filtered through 1.5 mm. Pt; or else, two radium tubes each containing 2 mg. radium element are inclosed in a platinum cartridge. Two such cartridges are placed in an India rubber tube and the latter is firmly fixed to a chain of characteristic design so that it may be recognized roentgenoscopically when locating the exact position within the pelvis.

The old technique consisted in placing two such cartridges within the pelvis. This was admittedly inadequate. The present technique involves the placing of six such cartridges symmetrically about the involved structure within the pelvis and thereby furnishing adeqate cross-fire. One cartridge is placed between the ischium spine and the edge of the sacrum. The second cartridge is placed by means of a superior incision in the region of the anterior superior iliac spine. The lower incision is made at about the level of the middle of the arch of the pubis. A pair of long, slightly curved tongs goes into the superior incision straight to just before the sciatic spine, and from there comes out through the lower opening to grip the chain of the second series of radium tubes. By pulling back the tongs, these tubes are pulled into place within the pelvis. The third, foremost set of cartridges is introduced after an incision is made in the abdominal wall on the level of the anterior superior spine between this spine and the middle line. A pair of large tongs is then brought through the fascia and under the peritoneum alongside the bladder and comes out in the same lower incision where it grips the

third cartridge, and by a backward pulling motion establishes it in the pelvis. The first cartridges are placed with their lower poles at the level of the sciatic spine, and the foremost cartridges at the level of the lower edge of the obturator foramen. If a roentgenogram taken immediately after operation shows the tubes placed in the wrong position with regard to the crater, improvement of position is easily practicable.

Dévé, F., Billiard, A., and Decoularé-Delafontaine, A. Hydatid cyst and penetration of roentgenotherapy. *Compt. rend. Soc. de biol., Par.*, 1924, xci, 931–932.

Arce and Ivanissevich, of Argentina, have reported favorable results from the treatment of hydatid cysts by the roentgen ray. They state that the size of the cysts decreases within a few days after irradiation. The writers have tried to repeat the work of the Argentine workers, but without success. A rabbit was inoculated with some hydatid cysts of sheep; a large cystic tumor was formed 4 cm. long, 2.7 cm. broad and 2 cm. thick. This was irradiated (420 days after inoculation) under the following conditions: Coolidge tube; spark 40 cm.; intensity 2.5 ma; focal distance 33 cm.; circular field 5 cm.; filtered through 0.5 mm. zinc and 1 mm. aluminum; time of irradiation, 1 hour; dose 2,000 R. Half of the cyst was protected with a sheet of lead 2 mm. thick to serve as control. A slight erythema was noted over the half irradiated. Aside from this, there was no change in the condition of the skin or tumor. The size and general appearance of the tumor remained unchanged. Histological examination of the excised tumor also showed no change due to the irradiation. This substantiates previous statements made by the authors, and seems to disprove the work of the Argentine roentgenologists.

Grove, Jno. L. Malignant cystic ovarian tumors. *J. Kansas M. Soc.*, March, 1926, xxvi, 71–75.

An unfavorable prognosis must be given to cystic tumors of the ovary which show teratoid or embryonic transformations not distinctly malignant but most prone to recur by implants. Early and thorough removal without rupture of the cyst wherever possible offers the best hope for cure. In the author's experience radium and roentgen rays seem to offer no assistance whatever in destroying embryonic tissue.

Three cases are reported in some detail, but in only one of these was roentgen therapy employed only after surgery had failed to control the condition.

Hess, Julius H. The treatment of pertussis by roentgen-ray. *J. Iowa State M. Soc.*, January, 1926, xvi, 29–33.

To carry on experiments on the treatment of whooping cough, the author received permission from the health departments of Illinois and Chicago to remove cases from their homes for treatment. Most of the cases were treated by the following technique: the roentgen tube was operated at 4 ma. and 7 inch spark gap, at a distance of 14 inches and the rays were filtered through 1 mm. Al. The time of exposure was 5 minutes, except in young infants when the first treatment at least was given for 2.5 to 3 minutes. In the majority of cases the treatment was given with the child on its back. In a few cases the position was changed during the course of treatment, half of the exposure being applied to the back. In the remainder, the anterior and posterior exposures were alternated. In no instance was the treatment repeated in less than five days, while in some the interval was as long as seven days. The number of treatments varied from one to four. More recently a few cases were treated with longer exposures, eight minutes, with the tube operated at 5 ma., 7 inch spark gap, distance 14 inches, 2 mm. Al.

In a considerable number, roentgenographic examinations disclosed marked hyperplasia in the glands about the hilus and in the peribronchial glands. In many instances there was a diffuse mottling extending for a considerable distance along the bronchial tree. The justification for the treatment is based on these findings and the knowledge that the roentgen rays exert a beneficial influence as evidenced by the tendency to reduction in the size of the hyperplastic lymphoid glands. Treatments should not be given before the paroxysmal stage is reached, because their chief function is to lessen the severity of the disease. There was a striking shortening of the course in some of the cases, but this must be considered of secondary importance and the treatments should not be continued with this idea in view.

There were 62 cases in the 1924 Summer and Fall group treated by the author, and 40 cases in the 1924–1925 Winter group. These were all children under the age of ten. In the Summer and Fall group prompt and marked improvement was noted in 43 per cent of the cases. In the Winter group the percentage dropped to 25. General improvement after roentgen treatment was observed in cases of secondary pneumonia. It is the author's opinion that excessive exposure of young children to roentgen rays is dangerous. The results both immediate and remote of roentgen treatment in whooping

cough should be given further study before the method is recommended for general use.

Jones, David H. Recent advances in the treatment of cancer. *J. Ophth., Otol. & Laryngol.*, April, 1926, xxx, 146–151.

In the Bronchoscopic Clinic at the Manhattan Eye, Ear and Throat Hospital there was one case of keratosis of the cord in which five biopsies were made, all of which were negative so far as malignancy was concerned until the last specimen was examined.

In extrinsic cancer of the larynx, surgical treatment should be used with block dissection of the gland area and with postoperative irradiation either by roentgen rays or radium. It has been claimed that radiation methods are painless and cause no scarring, but thorough treatment of a malignant tumor requires heavy dosage; and in the author's experience using radium needles in carcinoma of the larynx and epiglottis the patients complained very bitterly of the burning for some time; and also in the treatment by roentgen rays they suffered from the burning.

In borderline cases of gastric carcinoma, surgery should be used because deep roentgen therapy may damage adjacent organs. Borderline cases of cancer of the cervix have shown a wonderful response to radium treatment, although there have been reported a number of fistulas involving the wall of the bladder or rectum.

Inoperable cases should receive palliative treatment by radium but the amount of radium should be enough to produce results.

MacKenzie, David W. Bladder neoplasms. *Surg., Gynec. & Obst.*, December, 1925, xli, 753–758.

The inoperability of a large proportion of cases of bladder tumors is rightly attributed to the length of time elasping between the first symptom and the operation. The cystoscope has made the diagnosis so easy that there is absolutely no excuse for the long untreated histories which are found in those cases. It is not the absence of symptoms that causes havoc but rather the failure to appreciate the importance of early symptoms.

Blood in the urine is never physiological and it is a symptom demanding prompt investigation. An analysis of 821 hematurias in the clinic of the Department of Urology, Royal Victoria Hospital, Montreal, showed that 192 were due to calculi, 113 to tumors, 88 to renal tuberculosis and 143 to surgical infections of the ureters and kidneys, or excluding the urethra, 536 cases out of 761 were caused by calculi, tuberculosis, cancer or surgical lesions of the kidney.

With the cystoscope in the bladder, unless the bleeding is profuse, the growth within the bladder can easily be detected, and the surgeon can frequently determine from the cystoscopic picture whether the tumor is benign or malignant. Benign tumors melt away under fulguration, whereas the malignant ones are much more obstinate. The total number of cases observed by the author was 228, of which 118 were malignant. The pulse, temperature and respiration in uncomplicated cases are no aid to diagnosis. The chief complaint in 75 per cent of the cases was hematuria and in 25 per cent it was frequency.

The surgical treatment consisted in the extraperitoneal liberation of the bladder followed by excision. In the radium treatment emanation seeds were used and inserted through a hollow needle. When deep roentgen treatments were given, they consisted of a series of four treatments with 200 kv., 5 ma., 16 in. distance, with an exposure of 60 min. and filtration through 1 mm. Cu plus 1 mm. Al. One exposure was given over the symphysis, one over the sacrum and one over the right and left sacroiliac joints. The treatment was repeated at the end of six weeks. Five of the cases of malignant papilloma of the bladder were treated with cautery and radium resulting in 4 cures and one improvement, the result comparable to that obtained by cystotomy and cautery and by excision. Six cases of carcinoma were treated by cautery and radium with 4 cures, one recurrence and one death; 4 more cases were treated by excision and radium with 2 cures and 2 improvements. These results were more favorable than those obtained by excision alone. Deep roentgen therapy was administered in 6 inoperable cases resulting in 2 improvements.

Martius, Heinrich. So-called stimulative irradiation in gynecology. *Strahlentherapie*, 1926, xxi, 242–259.

Objection is raised to use of the term "stimulative radiation" since there is no conclusive experimental evidence that the mechanism is one of stimulation. A more preferable term would be "mild irradiation." However, it is unwise to classify the various roentgen therapeutic effects under any single term. For the present it would be preferable to designate each form of irradiation according to the organ, the disease or even the symptom that is being treated.

A brief review is given of the applications of roentgen rays in the treatment of the disturb-

ances of menstruation and sterility. It would seem very desirable to have stricter lines drawn regarding indications for temporary roentgen sterilization. At present many roentgen therapists are inclined to practice this treatment with more freedom than seems justified. This method of treatment should be avoided especially in the case of those women having prospects of child bearing. This viewpoint is supported by experiments conducted by the author upon white mice. The animals were given mild doses of rays insufficient even to cause temporary sterilization. The offspring from these animals were comparatively few in number and had a high mortality. The striking observation was made that the offspring from irradiated females were sterile. It is true that these observations cannot be carried over and applied directly to humans but the implications cannot be neglected.

Temporary roentgen castration is justified during the child-bearing period in women having old bilateral gonorrheal or tuberculous inflammations of the adnexa, in cases of pulmonary tuberculosis and in the control of ascending gonorrhea. Careful irradiation in obstinate cases of amenorrhea should be resorted to only as a final recourse. There is considerable danger in the radiation treatment of oligomenorrhea and polymenorrhea that the inadequate ovarian function may be completely eliminated instead of returned to normal.

Irradiation of the spleen has come to be recognized as an effective aid in the treatment of hypermenorrhea. A field 15 by 15 cm. over the splenic region is exposed. The rays are administered at a distance of 35 cm., a dose of 150 R being applied through 1.0 mm. Zn plus 1.0 mm. Al; 4 ma., 6.5 cm. gap across large spheres; time required about 12 minutes. The dose here mentioned refers to the incident primary beam measured with a free chamber and excluding recoil radiation. The effect of such a treatment is a very satisfactory control of the blood flow in juvenile hemorrhages and in adnexal inflammations. There is practically no effect upon climacteric hemorrhages. In general, it may be stated that in carefully selected cases, i.e., in hemorrhages of ovarian origin there will be a prompt effect in 75 per cent of the cases, and in 25 per cent the effect will be permanent.

Irradiation of the thyroid in conjunction with spleen irradiation has been found effective in certain cases. By employing careful dosage, this form of therapy is without danger and quite justified. However, its reliability still remains to be confirmed. Irradiations of the hypophysis should also be included especially in the treatment of climacteric and myomatous hemorrhages; but this form of therapy still remains to be investigated more fully.

A very favorable domain for the application of roentgen rays in gynecology is in the treatment of inflammations. The only definitely demonstrable direct effect of the rays in the inflammatory area is a destruction of the lymphocytes. Nevertheless the general clinical effect of such irradiation is very favorable. A large field is exposed from the umbilicus over the inguinal region and downward, and receives at a distance of 35 cm. 150 R units filtered through 1.0 Zn plus 1.0 Al. Measurement shows that this dose of 150 R primary radiation corresponds to the 20 per cent erythema dose recommended by Heidenhain and Fried for this form of treatment. The irradiation may be repeated if necessary in eight days. In the repetitions at intervals of eight to fourteen days, the chronic infections receive 75 R units per treatment. In this manner the ovarian dose is never reached. This form of therapy is attempted in younger women only when there is reasonable evidence that fertility has been affected. Under these limitations it appears that the roentgen treatment of gynecological inflammations is without hazard and constitutes an effective support to the customary methods of treatment.

Martius, Heinrich. The radiation treatment of adnexal tuberculosis in the female. *Strablentberapie*, 1926, xxi, 260–265.

There is a definite field of usefulness in the treatment of tuberculosis of the female genital adnexa with mild doses of roentgen rays. This, however, does not exclude surgery as the method of choice in those cases in which the disease has not advanced too far. All cases which are clearly diagnosed as genital tuberculosis, even when offering the possibility of local and general operability, are no longer from the standpoint of experience, suitable for surgical treatment. An energetic attempt should be made to control the disease in these cases with roentgen rays supported by the usual conservative medical measures.

There can be no doubt that it is more desirable to avoid an operative removal of tuberculous genital organs in cases in which there are extensive adhesions to the intestines, because of the danger of producing fistulas. In such cases all one can do is to remove ascitic fluid and depend upon the action of roentgen rays.

There is a further field for roentgen therapy in postoperative irradiation of all operated cases, especially those with fistulas. In this

field the reports on the effects of roentgen therapy are encouraging.

The technique of irradiation, direct or post-operative, is as follows: The lower abdominal region is exposed in a large field bounded above by the level of the umbilicus, below by the symphysis pubis and laterally by the anterior superior iliac crests. This area is irradiated at a focal distance of 35 cm., through 1 mm. Zn plus 1 mm. Al, with direct current of 6.5 mm. spark gap between large spheres. This field receives an incident primary irradiation of 150 R, *i.e.*, 25 per cent of the average erythema dose of 600 R. This irradiation requires 12 min. when 4 ma. are used. Three irradiations are given at intervals of eight days. The number of treatments is dependent upon the results obtained. In general, a series such as the above may be repeated at intervals of eight to twelve weeks. In cases of concurrent peritoneal tuberculosis, the abdominal field is extended above the umbilicus. This radiation therapy is safely within the roentgen castration dose.

MICHELSON, H. E. Dermatological clinic. *Journal-Lancet*, Jan. 1, 1926, xlvi, 5–9.

Ultraviolet rays are a valuable adjunct in the treatment of psoriasis but yet by no means specific. Roentgen therapy may be used but only in the hands of the expert, for in so chronic a disease as psoriasis there is always a danger of roentgen dermatitis.

A description is given of a case of acne vulgaris with roentgen dermatitis. The young man stated that he had had pimples on his face since he was a small boy and that some five years ago he was treated with roentgen rays. The treatments were given weekly over a period of a year and a half. At this time the skin is very dry, there is no growth of hair in the bearded region and even the eyebrows are lost. The skin is of a reddish color and on close examination shows a scar-like appearance with tiny blood vessels throughout. The loss of hair and the extreme dryness are due to atrophy of the pilosebaceous apparatus due to the action of the roentgen rays. The few acne pustules remaining are probably remnants of the original condition for which the man was treated. The whole picture is undoubtedly due to overdosage with roentgen rays. A good rule to follow in roentgen treatment is to avoid more than five or six suberythema doses of roentgen rays to the same condition, and then not oftener than one dose in two or three weeks, unless there is a very distinct indication and the therapist is fully competent.

The prognosis of chronic roentgen dermatitis is very bad so far as the condition itself is concerned. The atrophy and scarring cannot be remedied while the telangiectasis can be benefited only by most tedious use of electrolysis or cautery and then the cosmetic result will not be good. Moreover, keratosis and malignant degeneration must be constantly watched for in chronic roentgen dermatitis. A mild cream may be used to anoint the skin but there appears to be no specific remedy.

MILLER, RICHARD H. Modern aspects of the treatment of cancer. *J. Nat. M. Ass.*, April–June, 1926, xviii, 63–65.

Cancer on the face, forehead, or scalp if a very small growth, may be completely controlled by radium, but if excision can easily be done the latter is preferable. In more extensive growths, where a complete excision is impossible, the actual cautery may at times be used and then supplemented by irradiation. In cancer of the lip and tongue surgical removal with dissection of the glands of the neck should be done. In very late inoperable cases radiation may be tried but it will probably do little or no good.

In cancer of the breast early operation is the only treatment. This may be supplemented and in the majority of cases should be by roentgen treatment after operation. Pre-operative roentgen treatment of breast cancer is an open question. In frankly inoperable cases roentgen therapy should be tried since in some instances it certainly has been of great help in inhibiting and shrinking the growth. In cancer of the stomach, colon and rectum only surgery is of any avail. Radiation is considered useless.

For adenocarcinoma of the body of the uterus which is much less malignant than cancer of the cervix, complete hysterectomy should be performed. In cancer of the cervix, if early and localized, radical operation is usually preferable. In this connection it is necessary to bear in mind that radical operation has a high mortality, while treatment with radium has no mortality. It may be said that with radical surgery there is one chance in three of cure but with a definite chance of death from the operation, whereas with radium there is perhaps one chance in four of cure and no chance of dying from the application.

It should be borne in mind that the ordinary small roentgen machines found in the offices of many physicians are absolutely useless for the treatment of cancer. For this, only the newer powerful machines are of any avail, and then only when used by the experienced roentgen-ray specialist.

MOSCHCOWITZ, ALEXIS V., COLP, RALPH, and KLINGENSTEIN, PERCY. Late results after

amputation of the breast for carcinoma. *Ann. Surg.*, August, 1926, lxxxiv, 174–184.

The follow-up results three years after amputation of the breast are not considered as of great value, and even the results after five years cannot be considered as absolutely conclusive, since too many patients die after this period from recurrences or metastases.

For all practical purposes the fate of the patient is sealed at the time of the operation. The prognosis depends upon three factors: (1) the local extent of the process; (2) the presence of distant metastases, and (3) the care with which the operation is done. The modern operation is usually successful in eradicating the local process, as is evidenced by the very large number of cases dying from distant metastases without even a suspicion of recurrence at the site of operation. The late results of the operation are not as favorable as one might be led to believe from a cursory examination. At the present writing the surgeon is practically powerless in the presence of distant metastases.

The above are the conclusions drawn from a review of cases of breast carcinoma admitted at the Mt. Sinai Hospital, New York, from Jan. 1, 1915, to Dec. 31, 1924. There were 374 patients, in 218 of whom there were available complete reports suitable for analysis.

Since prophylactic roentgen irradiation was employed in only 6 of the patients, it is impossible to state accurately the benefits of preoperative irradiation. At the present time postoperative irradiation is employed almost as a routine measure, but recurrences have been observed to begin and increase in areas most intensively treated. A number of patients who are now alive and well and who are included in the follow-up statistics have received the benefits of postoperative irradiation. How much this has influenced longevity is conjectural.

Obladen, Paul. A portable support for the water phantom of the Siemens roentgen dosimeter. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, January, 1926, xxxiv, 171.

The stand furnished with the water phantom makes no provision for up and down adjustment. This inconvenience becomes a disadvantage where the position of the tube is more or less fixed and the focal skin distance has to be varied. The author describes an adjustable table which makes a vertical movement of 50 cm. and permits the suitable adjustment of the phantom.

Pankow, O. Irradiation of myomas and hemorrhagic metropathies. *Strahlentherapie*, 1926, xxi, 222–241.

The ovarian dose of roentgen rays has been established by Seitz and Wintz as 34 per cent of the skin erythema dose. This quantity of rays will destroy all the follicles in the ovaries regardless of their state of development. With modern roentgen apparatus this dose can be applied with considerable ease and precision; and the elimination of ovarian function where necessary can be readily accomplished. The mere existence of a myoma or hemorrhagic metropathy is no indication for radiation or surgical treatment. Elimination of the condition becomes indicated only if symptoms are produced that make it necessary.

There are certain local and general conditions which determine the desirability of roentgen deep therapy. For instance, it is necessary to determine that the growth is actually a myoma and not an ovarian tumor. The latter may often be a benign cystoma which does not respond to irradiation and grows further. On the other hand, ovarian carcinoma, if present, would be a serious condition if unrecognized during its early stage. The danger of a sarcomatous degeneration of the myoma although existent is not to be regarded very seriously, since in suspected cases the sarcoma dose of roentgen rays or else operation, which is nowadays favored by many gynecologists, would be sufficient. The submucous or subserous location of a myoma is not regarded as an indication against irradiation. Tumors with long pedicles are best treated by operation.

The mere size of a myomatous uterus is alone no contraindication to roentgen therapy. The type of enlargement and the accompanying symptoms are the deciding factors. Complications with inflammatory disease of the genital adnexa producing extensive adhesions with neighboring organs may make the operative treatment very difficult under certain circumstances. These are the cases which contribute to the operation mortality of myomas and are better suited for radiation therapy.

The great problem in the choice of therapy is the question of symptoms following elimination of function. In the treatment of myoma and hemorrhagic metropathy there are today three radical forms of treatment. These are (1) extirpation of the uterus with retention of one or both ovaries; (2) removal of the uterus together with all the adnexa, and (3) roentgen irradiation. Experience has shown that the acute symptoms following extirpation are milder after hysterectomy than after castration. These acute symptoms (psychic and especially vasomotor disturbances) show, after operative castration and after irradiation to the point of amenorrhea, no qualitative differences in intensity and no quantitative differences.

Since the type and intensity of these symptoms form the basis for deciding the form of treatment, the final conclusion is reached that hysterectomy is preferable to operative castration or roentgen irradiation. In cases showing a decided psychoneurotic taint, especially in women between thirty-five and forty-five years, operation is to be preferred and should be avoided only if the general condition is unfavorable.

RECHOU, G. Present technique of radium therapy. *J. de radiol. et d'électrol., Par.*, August, 1926, x, 359–368.

A systematic study of cancers in different locations has shown that there are certain rules that must be followed in the radium treatment of all cancers: (1) Radium should never be used in the treatment of generalized cancers in patients with cachexia. Any treatment of such cases does more harm than good. The so-called palliative results are disastrous and only shorten the life of the patient without controlling the pain. (2) Before treating a cancer with radium its boundaries should be known and its possibilities of extension. (3) A biological study of the tumor must be made to determine the form of its cells, as the time and method of application of the rays depend on its karyokinetic rhythm. (4) Whatever the region and whatever the form of the tumor external radium therapy is to be preferred to radium puncture. The latter method should only be used in exceptional cases where the former is impracticable. (5) The gamma rays used should always be the most penetrating ones possible; those obtained with platinum tubes with walls 1 mm. thick are sufficient and these tubes have the advantage of not reducing the radiation emitted too much. (6) The irradiation should always be applied from some distance, in order to reach deeper regions with larger doses and so get a higher coefficient of deep radiation. (7) The irradiation should cover a large area in order to encircle the whole tumor and follow up all its ramifications. All the glandular and lymphatic area belonging to the tumor should be treated the same as the tumor itself. (8) The doses used, which vary with the nature and extent of the tumor, should be distributed over a sufficient period of time and should vary also with the rhythm of multiplication of the tumor cells. (9) Every application of radium should be continuous. (10) So far as possible radium treatment should be given over a non-infected area.

These rules must be followed if large new growths are to be cured, and radium therapeutists should never undertake treatments if they have not powerful enough sources of radium at their disposal.

REIFFERSCHEID, KARL. The problem of temporary roentgen castration. *Strahlentherapie*, 1926, xxi, 266–274.

A review of the results from experiment animals indicates that the possibility of injury to the fetus by a previous roentgen irradiation of the maternal ovaries is not beyond the range of possibility. More extended studies with the most precise measurements carried over several generations will be necessary before the real effects are correctly understood. Even more difficult to judge than the animal observations is the question of fetal injury in humans. Although occasional reports have appeared tending to show a certain increased tendency to abortion in previously irradiated women, it may be stated that an absolutely proven case of fetal injury due to irradiation of the mother has not been established.

The possibility of such injury is, however, not excluded and it is concluded that this possibility exists after a temporary roentgen castration. The author therefore takes the view that until this possibility is definitely disproven, the procedure of temporary roentgen castration should be avoided on the grounds of the highest therapeutic principles.

REITTER, GEORGE S. The radiation treatment of nonmalignant conditions. *J. Med. Soc. N. Jersey*, October, 1926, xxiii, 489–493.

The following non-malignant diseases of the skin respond to radiation treatment: ring worm, birth marks of all varieties, warts of all varieties, leucoplakia, keratoses, keloids, soft corns, pruritus, acne, chronic eczema, psoriasis, dermatitis papillosis and the lichens. Tuberculosis of the skin occasionally responds to irradiation, but the author believes other measures should be tried first before resorting to irradiation.

Diseases of the Eye, Ear, Nose and Throat. Vernal conjunctivitis, trachoma, and cataract have been reported to be completely relieved by radium treatments. Certain of the resistant cases of vernal conjunctivitis have responded to irradiation after all other methods had failed. Radiation therapy should be reserved only for these difficult cases. Although it has been claimed that immature cataract may be treated by radiation therapy, the experience of the author with a series of such cases at the Newark Eye and Ear Infirmary resulted in only 2 improvements; and it therefore does not seem as if radium therapy can be given much credit in the treatment of this condition. Papillomas and small warts on the margin of the eyelid completely disappear after radiation treatment and leave no scar. Radiation is also of definite value in the treatment of papillomas

and granulomas in the external auditory canal. Tinnitis aureum and chronic deafness show but little improvement from it. The author has attained excellent results with radium in chronic ethmoiditis with recurrent nasal polyps. The polyps should be removed and the patient subjected within one or two days to irradiation in order to prevent recurrence. In a number of cases that had been subjected to ten or fifteen operations for polyps, there have been no recurrences following irradiation nearly three years ago. It is the author's opinion that radiation therapy should be used only in those cases of inflamed tonsils that cannot or will not undergo tonsillectomy. In about 80 per cent of infected tonsils treated by irradiation, fresh tonsillitis reappeared when conditions were right.

Exophthalmic or Toxic Goiter. About 70 per cent of those treated can be expected to remain cured; and there is no mortality and no harm done to the patient by radiation treatment in cases of toxic or exophthalmic goiter. Radiation therapy should not be employed in simple parenchymatous goiter, in the vascular type of enlarged thyroid, or in the cystic type.

Enlarged Thymus. Enlarged thymus may occur at any time up to the age of three or four and occasionally in adults. Roentgenologically the enlarged mediastinal shadow must be differentiated from new growth, syphilis, collection of fluid, enlargement of the great vessels and from enlarged glands. There are at times clinical signs of obstruction which show no evidence of enlarged thymus on the roentgenogram. The thymus is very sensitive to radiation and the results of treatment are often striking. The coughing and spasms disappear after one or two treatments. Enlarged peribronchial lymph nodes often appear in the hilus of the lung on chest films following influenza, bronchitis and particularly pertussis in children. Radiation treatment in these cases produces remarkable results. The author has treated a series of such cases with roentgen rays, and in every one the cough disappeared and subsequent films showed a recession of the enlarged nodes.

There is a large group of patients suffering from bronchial asthma who are not benefited or relieved by protein desensitization methods or vaccine treatments following the removal of infected foci. These are the cases which should be treated by roentgen rays because many of them may be relieved.

Tuberculous glands usually clear up under roentgen treatment. In both the lymphatic and splenomyelogenous leucemias radiation may be safely used as a palliative measure. In Hodgkin's disease definite remissions are usually obtained by radiation therapy though cure is not expected.

Uterine Hemorrhage Benign of Origin. In no other field of radiation therapy are such brilliant results obtained as in the treatment of benign uterine hemorrhage. In 98 per cent of the cases hemorrhage is stopped. If a fibroid is present it disappears in 80 per cent of the cases. There is no mortality as compared with 1 or 2 per cent after hysterectomy. There is no prolonged period of convalescence following three or four weeks of hospitalization. At most these patients are in the hospital but five days and are able to get around very soon after they are home.

Uterine Fibroids. The author insists that every case of benign uterine hemorrhage should as a routine be curetted prior to treatment in order to rule out possible malignancy. During the past two years he has found unexpected malignancy in the fundus in 2 cases and proper treatment was instituted. During the past three years he was treated with radium 38 cases of menorrhagia without fibroids and 59 cases of uterine fibroids. There were 3 failures in the menorrhagias. In 1 case at a subsequent operation a large ovary was removed with the uterus. There was one failure in the fibroid group; at operation small multiple fibroids were found scattered throughout the body of the uterus and 3 were pedunculated. The author's experience which has been almost entirely with radium indicates that the results with roentgen rays are just as promising.

Reyn, Axel. The value of concentrated arc light treatment in cases of roentgen and radium lesions of the skin. *Radiology*, June, 1926, vi, 457–468.

The value of the Finsen treatment by means of concentrated carbon arc light has not received the attention which it deserves. The danger to which the skin is exposed as the result of radium or roentgen treatment is exceedingly grave, although modern technique has advanced to the stage where "burns" are relatively rare. Although the number of roentgen accidents of all sorts will continue to decrease, it may never become possible to avoid them altogether. We possess in the Finsen treatment by means of concentrated carbon arc light a therapy in many ways of incalculable value. This treatment can be used to great advantage in nearly all the forms of roentgen lesions.

Under no circumstances is the mercury light used at the Finsen Institute for the therapy of roentgen burns. Experience has taught that the mercury light, probably owing to its abundant content of short waves, has rather a bad effect.

The author employs specially constructed carbon arc lamps of from 50 down to 20 amperes. The light is concentrated by means of quartz lenses into a small, very intensely luminous beam which is directed upon the diseased spot. To insure an effect of the light on the deeper layers of the skin, it is necessary that the latter be made bloodless by pressure, while at the same time the skin must be cooled in order to avoid heat burns. This double purpose is effected by the use of a compressor devised by Finsen, consisting of two quartz discs, one plane and the other planoconvex, between which a continuous stream of water is made to flow. These compressors are of different shapes according to the contour of the part against which they are to be applied, and it is necessary to have on hand an ample variety of them. The irradiation is given for only five minutes at a time, perhaps with slight variations depending on the seriousness of the cutaneous condition.

The treatment can be employed for all the various forms of roentgen lesions of the skin; but the results will be better and more quickly obtained the less extensive and severe the lesions. With very extensive burns of the fourth degree the chances of a good result are, as a matter of fact, exceedingly small. The treatment takes a long time and demands great patience, but the result is usually good. The roentgen ulcerations heal; the scars are smooth and elastic; and the strength of the skin to resist external influences is very considerable. At the same time it is believed that the danger of roentgen cancer is very much lessened.

There have been treated at the Finsen Institute 21 cases of roentgen lesions, and of these 4 broke off treatment prematurely. Of the remaining 17, thirteen have been cured. In one of the failures the treatment had no effect, but there was already a roentgen cancer present at the time Finsen treatment was begun and 3 cases are still under treatment and have improved. The 17 cases are briefly cited. The results in the "cured" cases are undoubtedly permanent, because in some of them the recovery already dates back a number of years, and because in the more recently healed cases the whole appearance of the skin has become entirely changed and has completely lost its roentgen-atrophied character. It is, of course, understood that besides the treatment with concentrated light, every other means at our disposal should be called into service which may in any way be expected to shorten the time demanded by the treatment.

RUBIN, I. C. Sterility associated with habitual amenorrhea relieved by x-ray therapy. *Am. J. Obst. & Gynec.*, July, 1926, xii, 76–88.

Habitual amenorrhea is associated with sterility in about 5 per cent of cases. Pregnancy takes place in about 5.5 per cent of the untreated cases. In 9 out of the author's 12 cases treated with mild doses of roentgen rays the women subsequently became pregnant. Only one of these patients aborted, and the rest carried to full term and gave birth to normal children.

Roentgen irradiation of the ovaries resulted in restoration of the menses in 11 out of the 12 cases of amenorrhea. The irradiation of the hypophysis area and the thyroid appears to be of adjuvant value. Two of the pregnant cases and 2 of the non-pregnant cases received hypophyseal irradiations. One of the pregnant cases also received thyroid irradiation.

Peruterine tubal insufflation and endocrine therapy are additional aids to the therapeutic action of roentgen rays in cases of amenorrhea associated with sterility. As the ovaries were found to be definitely enlarged before treatment in 8 of the 9 successful cases treated with roentgen rays, careful examination with regard to this point may prove of aid in selecting the cases of amenorrhea associated with sterility suitable for ovarian stimulation. When no ovarian enlargement is found, irradiation to the hypophyseal area or the thyroid may be more advisable and should certainly precede irradiation of the ovaries.

SCHUBERT, MARTIN. The treatment of skin tuberculosis. *Beitr. z. klin. Tuberk.*, 1926, lxiii, 939–946.

The radiation treatment of skin tuberculosis is at the moment quite distinctly the method of choice, first, because its results are considerably better and second, because the cosmetic effects surpass those from other forms of treatment quite considerably. The various forms included under the term skin tuberculosis are (1) lupus vulgaris and its variants, disseminated miliary lupus and lupus pernio; (2) tuberculosis verucosa of the skin; (3) scrofuloderma; (4) scrofulous lichen; (5) papulonecrotic tuberculide; (6) erythema induratum; (7) sarcoids (Boeck and Darier), and angiolupoid.

Light and roentgen rays apparently produce similar effects on the surface, although they may differ in their deep effects owing to differences in penetration. For general radiation in the treatment of skin tuberculosis one may resort to sunlight, the mercury vapor quartz lamp or the carbon arc light.

Roentgen rays are an additional aid in the control of local disease areas. The importance of roentgen therapy in the treatment of skin tuberculosis has been the subject of controversy during the past few years. There are some who

object entirely to its use in skin tuberculosis, while others consider it invaluable. The author takes a middle view and selects roentgen rays in suitable cases, administering small doses without a too frequent repetition. It must be recognized that large doses too frequently repeated have caused decided injuries and have been responsible for the formation of alabaster scars. One finds, however, certain types of lupus that react poorly and slowly to the usual light treatment and show improvement only after roentgenization. This is especially the case in tuberculosis cutis verucosa, scrofuloderma, and those forms of skin tuberculosis that tend to ulcerate.

The roentgen treatment is given with an Apex apparatus, Coolidge tube, 37 cm. parallel spark gap, 2 ma., half-value layer 2 cm. The rays are filtered through 2 mm. Al, the dose in general being 5 X, 1 to 2 cm. of healthy tissue being included in the treatment. This dose is repeated after four weeks and again if necessary after an additional four weeks. Further roentgen treatments are not given. The total of these fractional doses does not approach the skin erythema dose and injury therefore is avoided. Experience shows that this dosage is ample for a majority of cases.

Senty, E. G. The thyroid: Diagnosis and treatment, medical considerations. *J. Iowa State M. Soc.*, March, 1926, xvi, 103–107.

A brief outline is given of the various forms of goiter and their symptomatology and treatment.

The author believes that roentgen rays and radium in the treatment of exophthalmic goiter is unnecessary in by far the majority of cases. The danger of burns, telangiectasis, exacerbation of symptoms, production of myxedema from destruction of the gland and difficulty in surgical removal if this proves necessary make the radiation treatment inadvisable. Unless the technique becomes more perfected and the results more uniform and encouraging, surgery still remains the treatment of choice.

Simmons, Channing C. Cancer of the mouth: The results of treatment by operation and radiation. *Surg., Gynec. & Obst.*, September, 1926, xliii, 377–382.

A study is presented of 376 cases observed at the Massachusetts General and Collis P. Huntington Memorial Hospitals, Boston, in the three-year period 1918 to 1920. The cases were treated surgically, by radiation and by a combination of the two methods. In this report the term "cure" is applied to cases alive without evidence of disease three or more years after treatment.

Cancer of the buccal mucosa is a rapidly growing form of carcinoma and is often incurable in a few months from the onset of the disease. In primary cases without clinical evidence of metastases, surgical treatment offers 35 per cent chances of permanent cure as against 15 per cent by radiation treatment. In primary cases with clinical evidence of metastases, radiation treatment offers no chance of permanent cure and radical surgical treatment not over 5 per cent.

The methods of radiation employed were so varied that it was found impossible to draw conclusions from the small numbers falling in each group. The local growth was in most instances treated by the introduction of emanation seeds containing 1 to 5 mc. for each seed, the patient receiving 132 mc-hr. treatment of unfiltered radiation. In some instances surface application of radium was employed with a varied amount of screening. The glandular areas of the neck were treated either with radium packs or with short or moderately long roentgen rays. It was found necessary to judge each case receiving radiotherapy separately and to decide arbitrarily as to whether or not it had received what might be called sufficient radiation treatment to accomplish results.

The degree of malignancy varies somewhat as to the situation, cancer of the cheek and upper jaw being less malignant than cancer of the tongue or floor of the mouth. This is probably due to the fact that the papillary type is more common in the former positions.

Of the primary cases dying of a recurrence of the disease, life is prolonged by treatment, but the patient lives longer following operative treatment than following radiation treatment. In recurrent cases dying of the disease, in all groups, life is longer in the cases which received radiation treatment than in cases receiving no treatment. A certain group of cases which may be said to be "cured" by treatment are prone to develop a second cancer at some other point in the buccal mucosa. The results of treatment depend more on the amount of differentiation of the cells as determined microscopically, than on any other one factor.

Stern, Alfred, and Bott, Oskar. Uterine carcinoma recurrences after irradiation. *Strahlentherapie*, 1926, xxi, 426–443.

The authors were able to secure tissue sections in about 9 cases during the course of roentgen treatment of uterine carcinoma. The object was to determine histologically if the large percentage of recurrences might be explained by erroneous dosage or whether it was due to the nature of the disease or the general condition of the patient. The radiation

treatment employed was a combination of roentgen and radium irradiations. The roentgen rays were administered according to the Seitz-Wintz procedure. Three fields each on the abdomen and back, 6 × 8 cm. were exposed with the aid of a compression tube, 23 cm. focal skin distance. The dose administered was such that the confluence of beams at the tumor delivered 80 to 100 per cent of the skin erythema dose. Further irradiation is administered six to eight weeks later, the treatment depending upon the individual case. Several days after the first roentgen treatment, radium insertion is made which may be repeated.

The histological findings showed the typical pictures of carcinoma destruction observed many times before. The point that is stressed is the fact that there were frequently seen apparently intact carcinoma cells lodged in an area showing other cells undergoing extensive degeneration. The whole picture suggested the existence of differences in sensitivity of the cancer cells with corresponding differences in response to the radiations. The uterine musculature, connective tissue and mucosa showed hardly any changes as compared to those seen in the carcinoma. Many of the vessels also showed alteration. Preparations showing outspoken destruction of the carcinoma, frequently showed thickening of the intima, narrowing and obliteration of the lumens, while in the vicinity of undestroyed carcinoma these vessels appeared unchanged, all this seems to indicate that the injury to the carcinoma is directly due to a stoppage of the vascular system. In one case, the authors observed forty hours after radium treatment a severe damage to carcinoma cells while the vascular system appeared entirely unaffected.

Experience indicates that carcinoma cells showing well stained mitoses in the histological section may be regarded as a good index of the existence of a growing carcinoma or one capable of growth. In most cases recurrences will develop from these apparently viable carcinoma cell groups. Comparing cases in the same class, the observations show that the larger the dose of radiation, the better the therapeutic effect as indicated by the presence or absence of carcinoma cells two to three months after irradiation. There is, however, the disturbing factor that one finds no great parallelism between the dose and the effect. Indeed, in the 5 cases of corpus carcinoma studied, the results were worse as the dose increased in the various cases. The final conclusion is that whether one uses small or large doses of rays administered by any of the methods there is always present the possibility of leaving local recurrences. Although certain carcinoma cells in the irradiated zone are destroyed there is a certain proportion that appears to be uninjured regardless of the dose applied.

There is something in the cells of the carcinoma as a whole or in the host which determines the varying radiosensitiveness. Cases which do not respond to local irradiation cannot be made to respond better by some form of general therapy. If in these cases the carcinoma is operable it is advisable to remove the tumor surgically. The authors prefer in such cases to operate six to eight weeks after a roentgen treatment.

TEN DOORNKAAT KOOLMAN, MENNA, and KRETSCHMER, MARTIN. The roentgen treatment of pulmonary tuberculosis. *Beitr. z. klin. Tuberk*, 1926, lxiii, 684–698.

Five cases of pulmonary tuberculosis are reported in which good results were obtained with deep roentgen therapy. The experience with these as well as with numerous other cases treated in the University of Berlin clinic shows that the application of small doses together with strict individualization of the roentgen treatment is a very effective method for tuberculosis.

The first case, in a boy aged ten, was one of progressive exudative tuberculosis which gradually developed to a productive form with the patient in rather critical condition. Preliminary treatments of the hilic region were found to be tolerated, and these were followed by irradiations of the whole lung, repeated twice at intervals of three months. Irradiation of the whole pulmonary region was given through four fields front and back. Each field received a dose of 60 R.

The second case was in a boy aged four and a half years showing large pulmonary foci and pleuritic adhesions. During the roentgenization the connective tissue proliferated considerably in the involved left lung resulting in pronounced contractions of the mediastinum and thorax. The right lung, only slightly involved, did not develop any fibrosis. The total dose applied to the left lung was 255 R, or less than one-half of the skin erythema dose (600 R = 1 skin erythema dose). There was a pronounced reaction with fever and general symptoms after the first irradiation, but no other permanent effect resulted except the above-mentioned contraction. There was no atrophy of the skin despite the youth of the child. How this case will develop further on remains to be seen, but this child who showed a distinctly unfavorable prognosis was distinctly helped by the roentgen treatment.

The remaining 3 cases are similar examples

of the effectiveness of roentgen treatment in pulmonary and bronchial gland tuberculosis.

MISCELLANEOUS

Boyd, R. C. A method of mounting radiographs, and tests for vitality. *Radiology*, November, 1924, iii, 434–436.

The mount for dental films is made from an 8 × 10 duplitized superspeed film with three exposures, one each for the extraoral roentgenograms and a third to blacken the film surrounding them and mark the patient's name and the "right" and "left" letters. A lead sheet with suitable circular holes and corresponding disks of lead serve as stencils in preparing the mounts.

A plea is made for careful testing of the vitality of all suspected teeth before doing any new work upon them. Tests for vitality are not given in the present contribution, which is merely an emphasis of the need for such tests.

Child, C. M. Quantitative factors in the susceptibility of living cells to external agents. *Radiology*, January, 1925, iv, 21–32.

While the data now at hand concerning radiation do not permit us to draw final conclusions there is no reason to believe that the physiological basis of differences in susceptibility to any form of radioactivity is fundamentally different from that of susceptibility to other agents. The data are still fragmentary, but they indicate at present that nonspecific quantitative physiological differences are important factors in determining difference in radiation susceptibility. As in the case of other agents, regions or individuals with a higher rate of oxidative metabolism are in general more susceptible to the lethal or toxic action, and at least in some cases, more capable of acquiring tolerance to or of recovery from less extreme degrees of action, though the reversibility of effects appears to be slight for some forms of radiation. At present there seems to be no conclusive evidence that the differential susceptibility of tumor cells and normal tissue cells is anything more than this. The tumor cell is apparently a much more active one than the normal tissue cell and therefore more susceptible to extreme effects of external agents. If we could provide for equal exposure to other agents in the same degree as to radiation we should probably find that the differences in susceptibility between cancer cells and normal cells would be similar for certain ranges of other agents and for radiation, though they might differ in amount.

The difference in susceptibility corresponding to a given physiological difference is greater for some agents than for others and the facts at hand indicate that it is very great for at least certain ranges of the action of some forms of radiation. For example, preliminary experiments have shown that the physiological differences at different levels of the polar axis of certain of the lower invertebrates correspond to differences of several weeks in survival time with certain exposures to the beta rays of radium, while with a one-thousandth molar solution of potassium cyanide the physiological differences are represented by differences in survival time of a few hours; and with a two-hundredth molar hydrochloric acid, by differences of a few minutes. Probably the value of radiation in medicine is in some measure due to this high differential, in consequence of which a dosage sufficient to kill or inhibit the active cells of the neoplasm does very little or no lasting damage to the normal tissues.

Friedberger, E., and Shiga, Ak. The influence of radium rays on the components of the Wassermann test. *Ztschr. f. Immunitäts-forsch. u. exper. Therap.*, 1924, xxxix, 445–451.

The source of radiation was 85 mgm. radium bromide inclosed in a cylindrical metal capsule 2 cm. long. The fluid to be radiated was exposed in a layer 1 to 2 mm. thick to the radium which was suspended 1 to 2 mm. above the surface. Irradiation of Wassermann positive sera for 28 to 48 hours resulted in a gradual slight reduction in the intensity of the serum reaction as compared with controls not irradiated. This process of weakening continues after the radium has been removed. Negative Wassermann sera showed no effect.

Syphilitic liver extract is rendered inactive after long exposure to radium radiation. Briefer exposure of this antigen to less effective radiation showed a pronounced after-effect. Addition of cholesterol protects against the effects of radiation. Guinea pig heart extract is considerably more resistant and it also is protected by the addition of cholesterol. No effect of radium irradiation could be demonstrated in cholestarinized antigen.

The above observations of the effects of radium radiation are in many respects parallel to those observed on the effects of ultraviolet light.

Frik, Carl. Address on the opening of the Werner-Siemens Institute. *Therap. d. Gegenw.*, April, 1924, lxv, 145–148.

This new establishment constitutes the roentgenological section of the municipal Krankenhaus Moabit of Berlin. Most of

the equipment has been furnished by the Siemens and Halske Company. The Institute is arranged in three separate sections connected by passageways. One section is equipped for roentgen diagnosis and contains two sets of diagnostic apparatus, three examination rooms and a centrally located dark room. Another room is devoted to roentgen therapy and contains an ordinary therapy apparatus and one high capacity instrument. There is also a room for studying out plans for irradiation making use of the Holfelder field selector. A Siemens dosimeter is also available.

In both the therapy and diagnostic sections the three chamber system is employed,—that is there is complete separation of the mechanical, service and treatment rooms. One treatment room is provided with a Siemens radiation chamber which protects the patient from air impurities as well as high tension currents. The third section of the Institute is equipped for administration and research. This contains a roentgen laboratory with special apparatus for research, a small scientific laboratory for microscopic work and a demonstration room for teaching purposes, as well as rooms for physicist and for filing of negatives.

Hance, Robert T., and Clark, Harry. Studies on *x*-ray effects. XIV. The effect of *x*-ray on the division rate of *Paramecium*. *J. Exper. M.*, January, 1926, xliii, 61–70.

The inability of earlier workers to obtain any results after exposing protozoa or small metazoa to roentgen rays is probably because they were largely concerned with attempts to determine a lethal dose. Since the animals do not succumb even to very long exposures, it was concluded that they are insensitive to this physical agent. To demonstrate the reactions of *Paramecium* to roentgen rays it was necessary to observe a large number of individuals and to follow their descendants for several days. Two races of *Paramecium* were submitted for varying lengths of time to roentgen radiation and a large number of individuals were observed to determine the effect on the rate of division. The division rate of both races suffered a slight initial depression lasting two to five days after the exposure and followed by complete recovery.

Within rather wide limits the length of exposure made no appreciable difference in these experiments. Apparently the maximum effect of the rays is produced by relatively short exposures. Continued irradiation produced little further change until exposures of three to four hours were employed, when precisely the opposite results were obtained from those with shorter exposures. Doses repeated at various intervals have, in general, failed to interfere more markedly with the division rate than a single dose. Repeated irradiation caused the cells to become slightly swollen without apparent interference with their viability.

No direct evidence can be offered as to why protozoa or small metazoa are so slightly reactive to doses of roentgen radiation many times more than enough to kill a small animal. It may be that paramecia react very rapidly to their maximum after which no change occurs in them.

Kotzareff, A. Apropos the note of A. Lacassagne and J. Lattès on the elective fixation and harmfulness of polonium. *Compt. rend. Soc. de biol., Par.*, 1925, xciii, 471–472.

There is a fundamental difference between the emanations of polonium and radium, differences due to the physical properties of the two substances, and differences in their harmfulness and therapeutic value. It is impossible to obtain curiography with polonium in the living animal as may be obtained with radium. The polonium has an electivity for certain organs or certain cells which may be used when the organs are exposed directly on the photographic plate. The same phenomenon can be obtained with emanations of radium, under conditions which diminish its elimination, which is very rapid.

Laquerrière and Delherm. High frequency currents in the treatment of circulatory disturbances, *J. de radiol. et d'électrol., Par.*, July, 1926, x, 294–299.

Excellent results have been reported by many authors, especially American ones, from the thoracic application of diathermia in general diseases of the circulation but the authors of this article believe that while the various methods of application of high frequency currents may improve the functional symptoms they do not have any great effect on a constant hypertension nor on the hardened articles in arteriosclerosis. The conditions in which they have found diathermia extremely useful are local conditions, such as frost-bite, Raynaud's disease, obliterating arteritis and diabetic gangrene.

Maier, Eugen. Experimental studies on the intensity distribution of roentgen rays in the human body. *Strahlentherapie*, 1926, xxi, 480–493.

Comparative measurements in the human subject during therapeutic irradiation have yielded such varying results and are so difficult of interpretation owing to the few points

susceptible of measurement within the body that they could hardly be expected to produce consistent results. Thus measurements in the vagina showed a range of 32 to 60 per cent of the surface dose in patients of approximately the same thickness.

The author repeated the measurements made by Borell on the cadaver employing the customary distances and portals used in the Freiburg Clinic. Numerous measurements were made and a special technique of depth measurement was employed. Repetitions of the measurements agreed fairly closely, the measurements being made not only in the central beam but at various distances to the right and left. The values found are shown in charts and tables which must be consulted in the original for details. In general, the results of the measurements on the cadaver indicate that one must proceed with caution in transferring measurements made on the water phantom or other substances to the human body. The author believes that his experimental procedure gives a closer estimate of the real conditions because a schematic mathematical distribution of intensity in the body probably does not exist. In fact, the measurements show that this distribution is an individual one dependent upon the condition of the body and organs.

Russ, S. Experimental studies upon the lethal doses of *x*-rays and radium for human and other tumors. *Brit. J. Radiol.*, August, 1924, xxix, 275–292.

The animal tumor experimented on was the Jensen rat sarcoma. The tumor was removed aseptically and a thin slice of it, about 2 mm. thick, placed between sterile sheets of mica, sealed by vaseline. After irradiation small pieces of the tumor are inoculated subcutaneously into the right axilla of the animal, control pieces being inoculated into the left axilla. The lethal dose of radiation is defined as "that dose which it is necessary to give tumor tissue in order to prevent its growth when inoculated into normal, susceptible animals." It was found for the particular intensity of roentgen rays employed that it was necessary to expose a tumor about forty-two minutes to prevent the growth of 50 per cent of the tumors. If this time of exposure was increased to fifty-six minutes, a lethal action was obtained.

Another series of experiments upon the rat sarcoma show that if tumor cells are irradiated with almost a lethal dose their descendents will not be so sensitive to the same dose if it is repeated sometime afterward, and eventually the tumor cells may become extraordinarily resistant to the rays. These facts were established for irradiation both by radium and roentgen rays. It is evident, therefore, that the acquired resistance must be attributed to some action of the rays upon the cells of the tumor or its stroma. It should be remembered that the technique pursued in these experiments avoided irradiation of the animal, only the tumor being exposed and then inoculated into the susceptible animal.

A comparison was made between the lethal doses of roentgen rays and the reaction doses upon the skin of the rat. It was found that when soft roentgen rays (0.45 to 0.30 Å) were used partial epilation was obtained in twenty-one minutes, while for the same intensity of radiation, fifty-six minutes was necessary for lethal action on the tumor. When, however, the region of shorter wave lengths is used (0.168 Å) the partial epilation dose required 126 minutes, while the lethal action on the tumor was 146 minutes. Consequently, any specification of lethal doses for tumors in terms of a skin dose is intimately bound up with the differential action of roentgen rays of various wave lengths.

As a result of the immunity experiments which have been carried out upon a number of patients since 1920 it is possible to say something about the lethal dose of roentgen rays upon human tumors. The method mentioned consists in the irradiation by roentgen rays of human tumor material outside the body and the reintroduction into the body of this irradiated tumor tissue. From the data on the lethal dose reported above and from the knowledge that the animal tumors and human tumors had about the same degree of susceptibility, the dosage of radiation could be calculated. In order to allow for a sufficient margin of safety, twice the above lethal dose was administered to the human tumors before their reintroduction into the body. A summary is given of the results upon a wide variety of human carcinomas and sarcomas thus treated. In none of these cases was growth of the irradiated tissue observed. This experiment establishes at least an upper limit of dosage of human tumors.

The normal lethal doses of radium radiation from 1 mg., 10 mg., 25 mg., 50 mg., and 92 mg., radium bromide platinum tubes upon the rat sarcoma were studied. In those cases in which the result of the radiation was to diminish the normal percentage of "takes" (which is nearly 100 per cent) to a large extent, as for example, 70 to 80 per cent, these tumors nearly always grew at a very much reduced rate. Perhaps the most noticeable feature of the result is the comparatively small distance to which the lethal action extends for these

tubes even when the exposure continues for several days. There is a fairly rapid drop in the intensity of the radiation as one gets farther away from the tubes, but when allowance is made for this it appears from the results that the time of exposure has to be more than proportionately lengthened in order to get the same effect. It is not possible to continue the exposure with tubes containing as much as 50 mg. beyond four days owing to the fatal effect upon the animal.

The formulae of Mazeras have been utilized in the preparation of comparative figures for radiation intensity at different distances from a radium tube. This, together with the data above presented, permits the construction of figures giving the distances and the corresponding lethal exposure time. A study of such figures shows that in many cases the action of the rays upon the tumor is not exactly that to be expected if the lethal ranges followed exactly the intensity curve. It is evident that the product of intensity multiplied by time can only serve as a measure of dose within prescribed limits because if we reduce the intensity enormously the tissue of the body can withstand very weak radiation more or less definitely.

A study was made of the effect of roentgen radiation upon the resistance of the host to implantation of the rat sarcoma. The animals were subjected to 2 to 12-minute exposures daily for four to twelve weeks and it was found that normal tumors inoculated into them grew at a very much slower rate than in control animals. This, therefore, suggests that there may be some value in radiotherapy to supplement the direct irradiation of the tumor by a generalized irradiation of the body. This irradiation should be very weak in intensity and repeated at intervals over fairly long periods.

Calculation shows that the lethal doses above mentioned are the lethal doses for the growing cells. In the treatment of a tumor if it could be assured that the irradiation extended over the tumor so that all the cells of the tumor at some time or other were in the dividing stage, then the lethal dose that might be appropriate to the case would be a dose lethal for dividing cells, although during the whole time of exposure the mass of the tumor would be getting the irradiation. The standpoint adopted is that although dividing cells may be more vulnerable to irradiation than are the same cells in the phase of growth, it is rather upon the phase of growth that we must concentrate in order to ensure that the dose of radiation is adequate for the purpose at hand.

Solomon, Iser. The quantimetric units in roentgenotherapy. *J. de radiol. et d'électrol., Par.* August, 1924, viii, 351–356.

The unit for measuring the quantity of roentgen rays which seems most suitable is R, which may be defined as follows: the intensity of roentgen ray producing the same ionization as a gram of radium when placed in an ionization chamber and filtered through 0.5 mm. of platinum. The quantity of radiations will be given by the intensity of the radiation expressed as R. The importance of establishing such a standard is manifest. It will permit of standardization of roentgenotherapy and will give an international unit which is the same all over the world. This unit is used for the most part in France, by means of which great precision in the determination of roentgenotherapeutic doses has been possible.

A detailed historical sketch is given, and the principles involved in the unit recommended are illustrated by formulae. A discussion of other methods and formulae are also given.

Swann, M. B. R. A study of the immediate effects of *x*-rays on the functions of certain tissues and organs. *Brit. J. Radiol.*, June, 1924, xxix, 195–220.

The experimental studies were made upon cats, rabbits and guinea pigs, apparently in normal health. In all cases the aim in view was to demonstrate, if possible, any immediate functional change following upon exposure to roentgen rays. When exposing an intact animal as a rule no part of it was shielded from the rays. The roentgen-ray tubes employed were gas tubes of 8-in. bulb. No attempt was made to filter the rays. The factors of dosage were not always the same owing to the experimental difficulties of arranging the animal or isolated organ for purposes of recording tracings. The equivalent spark gap on the tubes used was never less than 4 in. and never more than 7 in., so that the rays employed may be described as of medium hardness. The number of millamperes passing through the tube varied between 1.0 and 2.0, being usually about 1.5.

The various experimental observations are recorded in the form of tracings. It was found that irradiation caused a gradual and regular lowering of the mean blood pressure in intact animals, and after prolonged exposure death occurred from cardiac failure. An adequate explanation of the fall in blood pressure is not yet forthcoming.

Respiration is stimulated by short exposures and depressed by longer ones; the final respira-

tory effect resembling that produced by morphine. The stimulation of respiration is probably produced by increased reflexes from the sensory nerve endings of the body and not by an excitation of the center in the medulla. As a result of exposure to roentgen rays the bronchiole muscles have been shown to constrict; and the autonomic nerves, vagus, sympathetic and splanchnic, are rendered more sensitive but may be depressed by prolonged exposure.

Roentgen rays cause the isolated rabbit's heart to stop in systole; short exposures increase the degree of contraction and occasionally also lengthen diastole. Prolonged exposures dilate the coronary vessels and cause the ventricle to enter into tonic contraction.

The isolated uterus of the virgin guinea pig is driven into tonic contraction after a latent period, and subsequently periods of tonic contraction alternate with periods of large automatic movements and the uterus returns to apparently normal condition, provided it is not further irradiated. In the intact animal roentgen rays cause the uterus to enter into a series of very large contractions but the latent period is longer than for the isolated guinea pig uterus and the onset of the contractions less sudden. There is also a rise in the mean tone. The tone of the uterine muscle and the size of the contractions approach a more nearly normal condition only after some hours following irradiation.

The tone of the rabbit's isolated intestine is steadily increased to an excessive degree by roentgen irradiation, the effect resembling that produced on plain muscle by such drugs as lead or barium. In the intact cat or rabbit, irradiation produces an increase of the intestinal movements and a slight rise in tone which gradually diminishes after irradiation is stopped. It is not yet possible to say whether the action of the rays is directly upon plain muscle or upon the autonomic nerve endings in the muscle.

Takahashi, M. The effect of irradiation with roentgen rays and ultraviolet light upon the course of avitaminosis. *Strahlentherapie*, 1925, xix, 124–137.

The well-known symptoms occurring in fowl as a result of feeding with polished rice may be developed in pigeons that are forcibly fed a diet excessive in calories and consisting of protein, fat and carbohydrate, as well as vitamine A. The characteristic symptoms are drop in body weight, nervous, irritative, and paralytic signs, hypochromic anemia, and reduction and alteration in the proportions of the various white cells. The duration of the disease and the time of death is the same as in animals receiving a polished rice diet. The irradiation of such hypovitaminous pigeons with ultraviolet light delayed somewhat the decrease in hemoglobin, while irradiation with roentgen rays produced no effect. Neither form of radiation showed any effect upon the number or proportions of the white cells.

The avitaminous fatty degeneration of the spinal cord may be prevented by ultraviolet irradiation, as has been shown by Ishido. It is quite possible that this may be due to the increased fat destruction as a result of the irradiation, thereby preventing the occurrence of fatty degeneration of the cord.

Experiments upon guinea pigs, rats and pigeons showed that irradiation has no effect upon the petechiae and hemorrhages of avitaminosis. Rachitic changes in the skeleton did not occur in these experimental animals so that conclusions as to the effects of radiation do not apply to avitaminous rickets. In pigeons the presence of vitamine A is practically without effect on the development of the various avitaminous changes. In guinea pigs, as well as in pigeons neither ultraviolet nor roentgen radiation seems able to delay the general course of the avitaminosis. On the contrary, according to Thomas, the symptoms in the guinea pig may be strengthened in this manner, from which it would appear that radiation in many ways has an effect similar to avitaminosis in its effect upon metabolism.